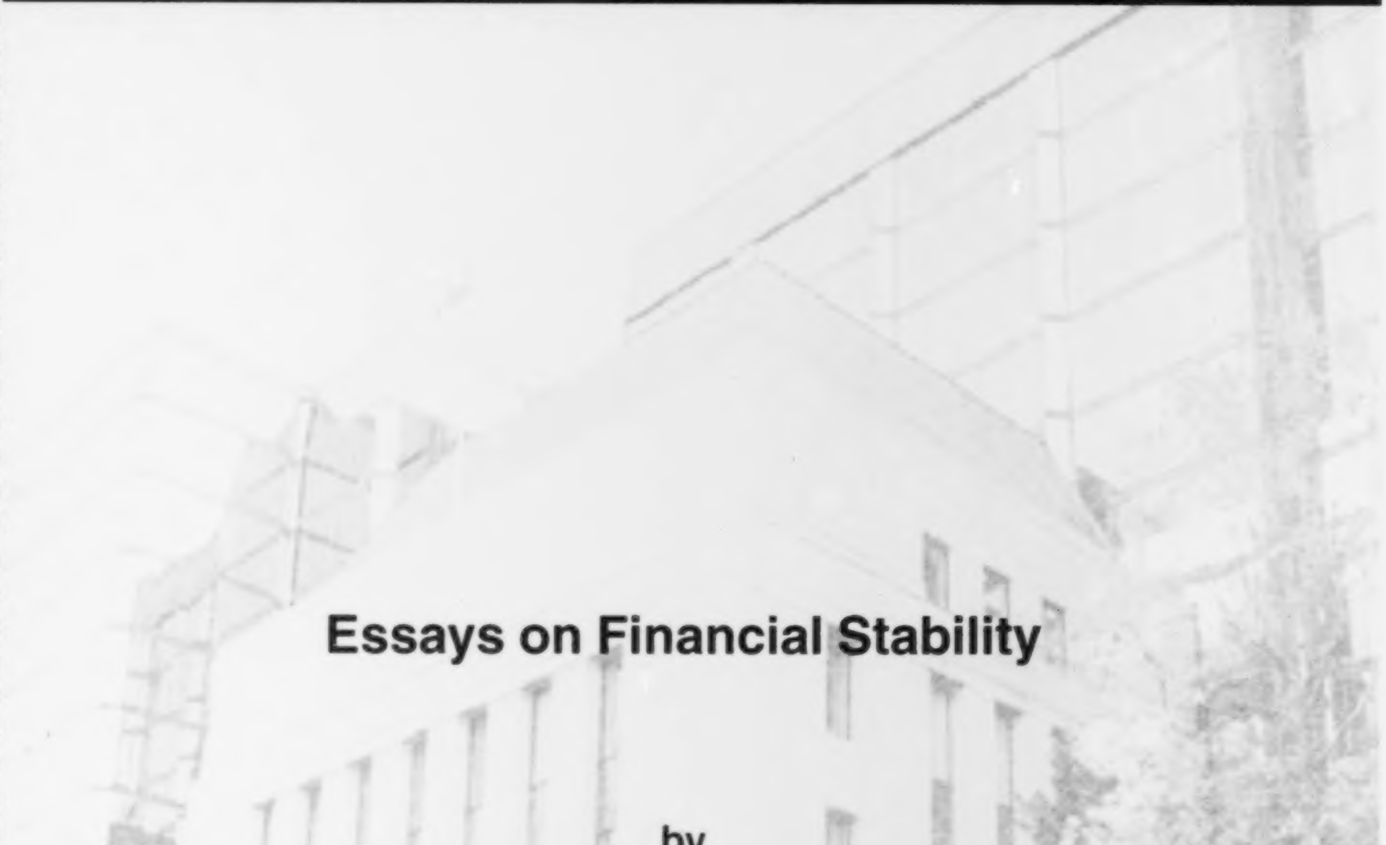
Bank of Canada Banque du Canada

Technical Report No. 95 / Rapport technique n° 95



Essays on Financial Stability

by

John Chant, Alexandra Lai, Mark Illing,
and Fred Daniel

103-07036/

September 2003

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ISSN 0713-7931

Printed in Canada on recycled paper

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Introduction

Over the past decade, there has been an increasing awareness of the effects that financial shocks can have on growth in the economy, the way in which unsound or weak financial sectors can propagate shocks arising in the real economy, the degree and speed with which shocks occurring in the financial system can spread to others, and the linkages between the financial systems of different countries. Indeed, the importance of financial activity in the functioning of the economy has become increasingly evident in the aftermath of the crises of the 1990s. At the same time, central banks have become increasingly sensitive to their role, along with other entities, in contributing to the objective of financial stability. There has also been an evolution of views on the nature of financial stability: how it can best be characterized, the causes of instability, and appropriate policy approaches. The four essays published here discuss these questions, as well as some of the key issues facing central banks and other bodies involved in times of financial system change, and highlight the diversity of views on many of these issues. Together, they provide a useful overview for anyone interested in understanding the issues and policy environment surrounding financial system stability.

The first three essays consider different aspects of the question, What is financial stability/ instability? The first essay, by John Chant, Special Adviser at the Bank in 2001–02, considers how financial instability differs from other kinds of instability, how it is different from the volatility normally associated with a well-functioning financial system, and how instability can be propagated within the financial system and to the real economy. He discusses these issues from the perspective of financial transactions. In particular, he discusses how heightened uncertainty about future outcomes and heightened complexity in the transactions between participants in the system can propagate financial system stress. He also emphasizes the infrequent and episodic nature of financial crises and the complications that this creates for understanding such crises and for formulating policy approaches to deal with them.

In the second essay Alexandra Lai tackles some of the problems raised by Chant; in particular, the difficulty of understanding the nature of crises. She does this through simple observation of the events commonly accepted as crisis episodes. Lai suggests that a more theoretical approach is needed to properly understand the underlying processes that drive such crises. She therefore reviews a range of theoretical approaches that have been pursued in order to understand the potential instabilities in domestic financial systems.

Lai characterizes financial crises as resulting from both an initial shock and the propagation of that shock to other markets and to the real economy. She groups theoretical approaches into those that explain the initial shock and those that explain the propagation. Explanations of crisis initiation include coordination failure and the failure of markets to provide liquidity to solvent but illiquid banks because of a lack of information or a lack of competition among liquidity providers. Propagation mechanisms include informational contagion, where agents doubt the solvency of one bank because of the failure of similar banks; direct credit exposures between banks; and financial-accelerator theories.

In his essay, Mark Illing provides concrete illustrations of some of the issues raised by Chant and Lai. He provides four case studies of episodes often thought of as periods of financial stress or crisis—the stock market crash of October 1987, the near-collapse of Long-Term Capital Management in 1998, the failures of the Canadian Commercial Bank (CCB) and Northland Bank in 1985, and the Bank of New York's 1985 computer problem. Illing's paper provides interesting examples of the variety of shocks that can trigger episodes of stress in the financial system. These include external shocks, operational problems, and, in the case of the stock market crash, a shift in expectations, the exact timing of which, even in hindsight, is hard to explain. The case studies also illustrate the kinds of contagion mechanisms that can turn isolated events into more widespread stress on the financial system. For example, the potential wealth effects associated with a stock market crash can affect consumption and investment expenditures, and the informational contagion that occurred with the failures of CCB and Northland led to a number of other small banks being shut out of wholesale markets.

Although the three authors take diverse approaches to examining what constitutes financial instability, a number of common themes emerge. First, significant changes in price variables, such as interest rates or bond spreads; changes in the quantity of credit or the availability of liquidity; and even the failure of individual banks or other financial institutions can all be part of the normal operation of the financial system. What distinguishes periods of financial instability, however, is that shocks affecting one market or institution spread to other markets and institutions with significant adverse systemic effects. Second, the definitions of financial instability used by the authors all include the concept of costs to the real economy; i.e., problems in the financial system spill over and impede the functioning of the real economy.

While these characteristics still do not allow us to reach a consensus on exactly where to draw the line between a stable, unstressed financial system and periods of financial instability, they suggest that this may not be necessary. A central bank is interested in financial instability because it impedes the normal functioning of the financial system, which in turn, impedes the ability of the real economy to mobilize resources effectively. The financial system does not operate in a binary manner, however, where stability suggests a perfectly functioning system and instability suggests a non-functioning system. Rather, the financial system operates in a continuum of states, where gradually increasing stress is likely to be associated with increasing problems in the system. It may be more productive, therefore, to put efforts into understanding underlying causes and mechanisms of financial stress and into empirically measuring the amount of stress in the system along a continuum, rather than to engage in what can become largely semantic debates about exact definitions of stability and instability.

The fourth essay, by Fred Daniel, provides a context for more general discussions of the role of policy in promoting financial stability, by providing an overview of the current institutional arrangements that condition financial behaviour in Canada, and how the Bank of Canada interacts with the other agencies who share responsibility for financial stability.

In discussions of financial system policy, it is important not to lose sight of the fact that two crucial determinants of the stability of the financial system are the general institutional structure of the system and the completeness of the information available to participants in the system. It is the design of the system that determines the incentives that influence financial behaviours, including those that induce financial institutions to take appropriate account of risks in their decision-making. In addition, and more subtly, inefficiencies in the financial system can lead to significant costs over time and may contribute to a system that is less able to successfully cope with periods of financial stress. While financial stability and efficiency have often been seen as possibly involving short-run trade-offs, it is now increasingly realized that, over the long run, a well-functioning financial system promotes both of these objectives in a complementary fashion.

In Canada, as noted, responsibility for financial system stability resides with several federal and provincial entities. In recent years, the Bank has worked at defining its role in this area. The Bank has responsibility for the conduct of monetary policy. Well-run monetary policy both contributes to, and is clearly facilitated by, the presence of a stable financial system. In addition, the Bank has a legislated oversight responsibility with respect to systemically important clearing and settlement systems. Further, as a result of the Bank's ability to create liquidity and its role as lender of last resort, it has an inherent interest in developments within the financial system (in terms of both underlying structure, policies, and current developments) that could affect the probability of the Bank acting as lender of last resort.

A broader motivation also underpins the Bank's role in the financial system. As the public monetary authority, the Bank has developed extensive and specialized expertise with respect to the Canadian financial system. In conjunction with the substantial macroeconomic knowledge base contained "in-house," Bank staff are relatively well positioned to identify and assess macro-financial developments and systemwide risks and to provide views on policies to foster the appropriate evolution of the financial infrastructure. Thus, the Bank can contribute to analysis of the financial system by applying this expertise, typically from a systemwide perspective, to surveillance, policy advice, and research on a range of financial activities.

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July 2003

Introduction

Au cours de la dernière décennie, on a pris de plus en plus conscience des effets que les chocs financiers peuvent avoir sur la croissance économique, de la manière dont les secteurs financiers faibles ou en difficulté peuvent propager les chocs qui surviennent au sein de l'économie réelle, de la rapidité avec laquelle les chocs se produisant dans un système financier peuvent se propager aux autres, de l'ampleur que ces chocs peuvent prendre et des liens qui unissent les systèmes financiers des différents pays. En effet, l'importance de l'activité financière dans le fonctionnement de l'économie est devenue de plus en plus manifeste dans la foulée des crises des années 1990. Parallèlement, les banques centrales se sont préoccupées davantage du rôle qu'elles jouent, de concert avec d'autres entités, dans l'atteinte de l'objectif que constitue la stabilité financière. Les points de vue sur la nature de cette dernière ont également évolué, notamment en ce qui concerne la meilleure définition qu'on puisse en faire, les causes de l'instabilité et les approches appropriées en matière de politique monétaire. Les quatre essais publiés dans les pages qui suivent portent sur ces aspects ainsi que sur certaines des principales questions auxquelles les banques centrales et les autres organismes concernés doivent faire face en période de changement du système financier, et soulignent la diversité des opinions sur bon nombre de ces questions. Ensemble, ils donnent un aperçu utile aux personnes désireuses de comprendre les enjeux et le contexte des politiques publiques entourant la stabilité du système financier.

Les trois premiers essais examinent, sous divers angles, en quoi consistent la stabilité et l'instabilité financières. Dans le premier essai, John Chant, conseiller spécial à la Banque en 2001-2002, se penche sur ce qui distingue l'instabilité financière des autres types d'instabilité et de la volatilité normalement associée à un système financier qui fonctionne bien; il examine aussi les voies par lesquelles l'instabilité peut se propager à l'intérieur du système et atteindre l'économie réelle. L'auteur étudie ces questions sous l'angle des opérations financières. Il explique, en particulier, comment l'incertitude accrue entourant les revenus futurs et la grande complexité des transactions entre les participants peuvent contribuer à propager les tensions présentes au sein du système financier. Il souligne également le caractère peu fréquent et épisodique des crises financières, et les complications que cela entraîne pour la compréhension de ces crises et pour la formulation des politiques visant à les régler.

Dans le deuxième essai, Alexandra Lai aborde certains des problèmes soulevés par Chant, notamment la difficulté qu'il y a à cerner la nature des crises. Elle procède par la simple observation des événements généralement considérés comme des situations de crise. Selon l'auteure, il faut recourir à une démarche plus théorique pour comprendre correctement les processus sous-jacents qui alimentent les crises. Elle passe donc en revue diverses approches théoriques qui ont été suivies pour comprendre l'instabilité potentielle des systèmes financiers nationaux.

Lai décrit les crises financières comme la résultante à la fois d'un choc initial et de la propagation de ce dernier aux autres marchés et à l'économie réelle. Elle regroupe, d'une part, les approches théoriques qui expliquent le choc initial et, d'autre part, celles qui rendent compte de la propagation. Les explications du déclenchement des crises comprennent, entre autres, l'échec de la coordination et le refus des marchés de fournir des liquidités aux banques solvables mais peu liquides en raison d'un manque d'information ou d'une concurrence insuffisante des fournisseurs de liquidités. Parmi les mécanismes de propagation, mentionnons la contagion mimétique — où les agents mettent en doute la solvabilité d'une banque en raison de la défaillance d'institutions financières semblables — l'exposition directe entre banques et le phénomène de l'accélérateur financier.

Dans son essai, Mark Illing illustre, par quelques exemples concrets, certaines des questions soulevées par Chant et Lai. L'auteur présente quatre études de cas d'événements ayant souvent été considérés comme des périodes de tension ou de crise financières : le krach boursier d'octobre 1987, le quasi-effondrement de la Long-Term Capital Management en 1998, la faillite de la Banque Commerciale du Canada (BCC) et de la Norbanque en 1985 et, la même année, le dysfonctionnement du système informatique à la Bank of New York. L'article d'Illing fournit d'intéressants exemples de divers chocs qui peuvent déclencher des tensions au sein du système financier, entre autres, les chocs externes, les problèmes d'ordre opérationnel et, dans le cas d'un krach boursier, la modification des attentes, dont le moment exact est difficile à expliquer, même *a posteriori*. Les études de cas portent également sur les genres de mécanismes de contagion qui peuvent transformer des événements isolés en tensions plus généralisées s'exerçant sur le système financier. Par exemple, les effets potentiels d'un krach boursier sur la richesse peuvent influencer les dépenses de consommation et d'investissement. Par ailleurs, la contagion mimétique qui s'est produite lors des défaillances de la BCC et de la Norbanque a eu pour conséquence d'évincer un certain nombre d'autres petites banques solvables des marchés de gros.

Bien que les trois auteurs susmentionnés adoptent des méthodes diverses pour examiner les éléments constitutifs de l'instabilité financière, plusieurs thèmes communs émergent de leurs travaux. En premier lieu, les modifications importantes touchant aux variables de prix, telles que les taux d'intérêt ou les écarts entre rendements obligataires, les variations du volume du crédit ou de la disponibilité des liquidités et même les faillites de banques ou d'autres institutions financières, peuvent toutes se produire lorsque le système financier fonctionne normalement. Toutefois, ce qui caractérise les périodes d'instabilité financière, c'est l'importance des effets négatifs systémiques de la propagation des chocs d'un marché ou d'une institution financière aux autres marchés ou institutions financières. En second lieu, les définitions de l'instabilité financière utilisées par les auteurs comprennent toutes le concept des coûts subis par l'économie réelle, lesquels apparaissent lorsque les problèmes qui affligent le système financier se propagent et finissent par entraver le bon fonctionnement de l'économie réelle.

Cependant, bien que ces caractéristiques ne nous permettent pas d'atteindre un consensus sur le tracé précis d'une ligne de démarcation entre les périodes où le système financier est stable et dépourvu de stress et les périodes d'instabilité financière, elles laissent entendre que cela n'est peut-être pas nécessaire. Une banque centrale s'intéresse à l'instabilité financière parce que cette dernière constitue un obstacle au fonctionnement normal du système financier, obstacle qui à son tour entraîne une diminution de la capacité de l'économie réelle à mobiliser efficacement ses ressources. Le système financier n'est pas tranché au point où, d'une part, stabilité rime avec fonctionnement parfait du système et, d'autre part, instabilité financière est synonyme de non-fonctionnement du système. En fait, celui-ci fonctionne plutôt dans un continuum d'états où l'intensification graduelle des tensions s'exerçant sur lui est probablement associée à l'augmentation des problèmes auxquels il se heurte. Il pourrait donc s'avérer plus productif, pour une banque centrale, de concentrer ses efforts sur la compréhension des causes fondamentales et des mécanismes du stress financier et sur la mesure empirique du volume de stress dans le système, le long d'un continuum, plutôt que de s'engager dans un débat à caractère fortement sémantique à propos des définitions précises de la stabilité et de l'instabilité financières.

Dans le quatrième essai, Fred Daniel fournit le contexte d'une discussion plus générale sur le rôle que joue la politique monétaire dans la promotion de la stabilité financière. Ainsi, il donne une vue d'ensemble du cadre institutionnel actuel, qui conditionne le comportement financier au Canada, et de la manière dont interagissent la Banque du Canada et les autres organismes partageant avec elle la responsabilité d'assurer la stabilité financière.

Dans le débat entourant le rôle de la politique monétaire, il est important de ne pas perdre de vue le fait que deux déterminants cruciaux de la stabilité financière sont la structure institutionnelle générale du système financier et le degré d'exhaustivité de l'information dont disposent les opérateurs du marché. C'est la façon dont est conçu le système qui détermine les incitatifs modulant les comportements financiers et amenant notamment les institutions financières à bien prendre toute la mesure des risques dans leur processus de prise de décision. En outre, et plus subtilement, les inefficiences qui affectent un système financier peuvent entraîner une augmentation importante des coûts de ce dernier au fil du temps et contribuer à miner sa capacité de faire face aux périodes de stress financier. Bien que l'on ait souvent considéré que la stabilité financière et l'efficience pouvaient faire l'objet de compromis à court terme, on s'aperçoit de plus en plus maintenant qu'à long terme, un système financier qui fonctionne bien favorise, de façon complémentaire, la réalisation de ces deux objectifs.

Au Canada, comme il a été souligné, la responsabilité de la stabilité du système financier incombe à plusieurs entités fédérales et provinciales. Ces dernières années, la Banque s'est employée à définir son rôle à cet égard. Elle est responsable de la mise en œuvre de la politique monétaire, qui, si elle est bien menée, contribue à la stabilité du système financier. Et un système financier stable facilite à son tour la conduite de la politique monétaire. Par ailleurs, le législateur a confié à la Banque la surveillance des systèmes de compensation et de règlement d'importance systémique. Enfin, en tant que créateur de liquidités et prêteur de dernier ressort, la Banque s'intéresse intimement à tout ce qui, au sein du système financier (structure sous-jacente, politiques et évolution du moment), pourrait avoir une incidence sur le recours à ses services de prêteur de dernier ressort.

L'intérêt de la Banque du Canada pour le système financier tient aussi à un motif plus général. En sa qualité d'autorité monétaire au pays, la Banque a acquis une expertise importante et très pointue en ce qui concerne le système financier canadien. Grâce à la forte base de connaissances macroéconomiques internes que possède son personnel, cette institution est relativement bien placée pour cerner et évaluer les faits nouveaux sur la scène macrofinancière et les risques systémiques, et donner son opinion sur les politiques permettant de favoriser une évolution opportune de l'infrastructure financière. La Banque peut apporter sa contribution à l'analyse du système financier en appliquant cette expertise, généralement dans une perspective d'ensemble, à la surveillance du système financier, à la formulation de recommandations en matière de politiques et à la recherche sur toute une gamme d'activités financières.

Dinah Maclean
Études monétaires et financieres
juillet 2003

Financial Stability as a Policy Goal

John Chant

I am indebted to Michael Bordo, Walter Engert, Chuck Freedman, Clyde Goodlet, Mark Illing, Ying Liu, David Longworth, Dinah Maclean, John Murray, Sean O'Connor, Larry Schembri, Jack Selody, Pierre St. Amant, and Peter Thurlow for their contributions to this work.

1. Introduction

During the 1990s, increasing attention has been paid to financial stability as a policy goal of central banks. Several central banks now publish financial stability reviews, which assess current conditions, describe ongoing legal, regulatory, and institutional developments, and discuss proposals to strengthen financial stability. Their officials also participate in forums devoted to developing policies to foster financial stability. The mandates of some central banks have now been expanded to cover responsibility in areas vital to the maintenance of financial stability.

The goal of financial stability is not new for central banks. It was an objective of some central banks in the late nineteenth century. However, financial stability was not the goal of the earliest central banks, which can be traced back to 1668 for the Riksbank and 1694 for the Bank of England. Their responsibilities then were very different from those of today. The Riksbank was established as a government-owned commercial bank to replace a failed private bank, while the Bank of England was created by the sovereign, primarily to fund his spending. While central banks have traditionally been closely identified with issuing currency, the activities of early central banks in this regard were incidental. Their rights and privileges with respect to currency provided their compensation for funding their governments.[1] Activities resembling those of modern central banks emerged relatively late in their evolution. As Bagehot recognized, the beginning of the practice of central banking was marked by the Bank of England's awareness that its dominant position meant that its stake in system stability differed materially from that of other banks. It could, as a result, become the focus of any uncontrolled financial pressures. Indeed, it was concern about financial stability that spurred the emergence of new central banks in the early twentieth century. The establishment of the Federal Reserve system in 1913, for example, was the direct result of a series of financial crises in the United States.

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[1] The term "a great engine of state" was used by Adam Smith to describe the Bank of England in its role as the government's banker in managing its debt and advancing it funds and not in its role with respect to financial stability. See Book Two, Chapter Two of *An Inquiry into the Nature and Causes of the Wealth of Nations* (http://www.adamsmith.org.uk).

Despite its standing as a central bank goal as early as the 1870s and its importance as a motive for establishing new central banks, financial stability received less priority than other goals during most of the second half of the twentieth century. Stable exchange rates were the focus of the Bretton Woods period after World War II; short-term economic stabilization was at the forefront during the 1960s and 1970s; and longer-term monetary stability, especially the targeting of low and stable inflation, became the goal of the 1990s. Nevertheless, the renewed emphasis on financial stability does not represent as marked a change as it might appear; financial stability is related in concept to the goal of monetary stability—the dominant goal in the 1980s and 1990s. It too can contribute to an environment that fosters economic growth and efficiency. Still, the goal of financial stability itself, the criteria for its success, and the means for its attainment are different enough from the other objectives to be considered separately.

Most recent headline experiences with financial crises have centred on developing and transitional economies that lack the depth of institutional development found in developed economies. Indeed, most developing and transitional economies have suffered from financial crises in one form or another over the past 20 years.[2] Still, central banks in developed economies have increasingly become involved in issues of financial stability. This concern may seem misplaced for a developed economy; especially for Canada, given its past record. The absence of bank failures for 60 years, from the early 1920s until the early 1980s, together with the low costs of the financial failures that did occur suggests that this issue is well taken care of and can generally be ignored. In light of this, what is the relevance of financial stability to developed economies? Are not questions of financial stability mainly of concern for developing and transitional economies?

The renewed concern of central banks and others reflects an awareness that episodes of financial instability have not been confined to developing economies in recent years. Table A1 in the appendix shows the crises—full-fledged and borderline—that have afflicted the financial systems of developed economies from the 1970s onwards. While Canada has faced only what Caprio and Klingebiel characterize as a "borderline crisis," Table A2 shows that since the 1980s our financial system has undergone several episodes of evident financial pressure.

This paper is directed to explaining the role and implications of financial stability as a central bank objective by focusing on its meaning and discussing its benefits. It considers the consequences to

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2. Caprio and Klingebiel (1999) document 114 episodes of financial crises in 93 countries and 51 episodes of borderline and non-systemic crises since the 1970s.

the economy of failing to achieve financial stability. This task, however, is not straightforward: the meaning of financial stability must first be established to set a benchmark for determining the costs of failing to achieve it.

2. What is Financial Stability?

This question can best be answered by considering its absence—the failure to attain it through the presence of financial instability. To answer this question two distinct issues must be resolved: the basis on which "financial instability" can be distinguished from other sources of instability and the basis for identifying the presence of "instability" in the financial sector. Both raise further questions. With respect to the first, financial instability is only one form of economic instability to which an economy can be subject. Are there clear dividing lines between financial instability and other types of instability, such as macroeconomic instability? If so, what distinguishes "financial" instability from the others?

Just as fundamental is the *question* of instability itself. Market prices and interest rates continually fluctuate. These fluctuations contribute to the vitality of a market economy by providing the familiar signalling and rationing functions of markets. But such changes in prices and interest rates continually alter the balance sheets of both households and business enterprises. Are all movements of interest rates and prices signs of instability? What criteria distinguish instability from changes that characterize the normal working of a market economy?

2.1 The financial dimension of instability

Financial instability refers to conditions in financial markets that harm, or threaten to harm, an economy's performance through their impact on the working of the financial system. It can arise from shocks that originate within the financial system being transmitted throughout that system, or from the transmission of shocks that originate elsewhere by way of the financial system. Such instability harms the working of the economy in various ways. It can impair the financial condition of non-financial units such as households, enterprises, and governments to the degree that the flow of finance to them becomes restricted. It can also disrupt the operations of particular financial institutions and markets so that they are less able to continue financing the rest of the economy.

This definition suggests several differences between financial instability and other forms of instability. The immediate sources of financial instability often include events in broadly defined financial markets. While historical experience indicates that the threats to financial stability in developed economies are varied, they generally originate in the banking system as a consequence of the over-extension of credit by financial institutions to particular sectors (as in the Less Developed Countries [LDC] debt crisis of the early 1980s) or from sharp movements in asset prices (as in the stock market crash of 1987). This contrasts with macroeconomic instability, which arises from aggregate demand shocks reflecting changed expenditures, or aggregate supply shocks initiated by technological shifts or changes in the supplies of productive inputs. This separation between financial and other forms of instability is not complete. A sufficiently large expenditure or supply shock, for example, may precipitate instability through its impact on the financial condition of households or businesses and, in turn, the condition of the financial sector. The propagating mechanisms for financial instability, whatever its origins, also differ from those of macroeconomic instability. Financial instability is propagated through changes in assets prices or in the financial condition of households, businesses, and financial institutions.[3]

The restriction of financial instability to "events in financial markets" lends only limited precision to the concept. Such imprecision, however, appears unavoidable. The concept of financial instability really serves as a genus embracing many species of instability. It differs from time to time and from place to place according to its initiating impulse, the parts of the financial system affected, and its consequences. Threats to financial stability have come from such diverse sources as the default on the bonds of a distant government; the insolvency of a small, specialized, foreign exchange bank; computer breakdown at a major bank; and the lending activities of a little-known bank in the U.S. Midwest.

2.2 Criteria for instability

Interest rates and asset prices change by the day, by the hour, and by the minute. So do the financial conditions of businesses, households, and financial institutions. While sometimes substantial, the changes that characterize the normal workings of financial markets, although vitally important to central banks in conducting monetary policy, are not themselves indicators of financial instability. What, then, distinguishes changes in financial conditions that signal instability from these other changes that take place continually? Are there, for example, benchmarks for the scale that could separate events that threaten financial stability from those that do not? As we will see, what is, or what is not, financial instability depends upon its impact on the ability of the economy to produce goods and services. Any shock affecting the financial sector to a degree that significantly impairs the continuing productive ability of the economy can be characterized as financial instability. Whether a shock to the financial sector meets this criterion depends, in addition to the size of the shock, on such things as the conditions of households and businesses at the time of the shock, the robustness of financial markets and their institutions, the state of expectations, and the reaction of central banks and other authorities.

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[3] The initiation and propagation of shocks are discussed more fully in the essay by Mark Illing.

The different effects of changes in asset prices and interest rates can be used in drawing a line between normal changes and changes that reflect instability. It is inescapable that changes in securities prices or interest rates benefit some people and harm others. For example, higher interest rates arising from a heightened perception of risk harm borrowers. But for small short-run changes, these effects are limited primarily to their impact of raising borrowers' financing costs: they have little effect on the economy's overall ability to produce the goods and services that determine economic well-being. More extreme and prolonged swings in prices and interest rates have real costs because they damage the working of the financial system by reducing its ability to channel funds efficiently from lenders to borrowers, to deal with risks effectively, or to provide the payments services—all functions vital to a vibrant economy. In addition, the threat of financial instability can lead to defensive responses that hinder the effective working of the financial sector. The presence of these real costs, costs that impair the economy's productive capacity, provides the boundary between financial instability and other movements in prices and interest rates. The nature of these costs is discussed further in the next section.

3. Instability and the Financial Sector

Threat of financial instability is an inherent concern with respect to financial markets, a concern justified by historical experience. This experience is not a coincidence: the possibility of financial instability arises from the properties that define financial transactions and the distinctive architecture of financial systems.

Financial transactions, by definition, differ from many other transactions. Typically, they are transactions in which one or both parties commit to future obligations. At least one party remains uncertain whether this obligation will be fully met, a doubt that may last no more than minutes for transactions in clearing and settlement systems and decades for transactions in long-term bonds.[4] This uncertainty creates a source of instability that is absent from many other markets. Here, participants must make decisions based on judgments of future performance rather than on what the other party actually delivers. These judgments may be susceptible to swings in response to changes in one or several signs that indicate future performance, even though they provide an incomplete picture.

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[4] At one time, the British and Canadian governments had perpetual bonds outstanding that, at least in concept, had an unending stream of interest payments.

The most basic financial transaction expresses performance obligations of two parties to each other. In simple transactions, such as loans, the continuing obligation runs just one way: one party fulfils its obligation by making the loan, while the other party commits to repay the loan as specified. In these transactions, the lender must assess the borrower's willingness and ability to repay in determining its willingness to lend. In doing so, a lender will balance the costs of more complete assessment of the borrower's capacity against the benefits from reducing the uncertainty of the outcome. Once the loan has been undertaken, the lender will also balance the benefits arising from greater expenditure of effort on supervision and monitoring against the costs. From this perspective, the failure of a borrower to repay is a possibility of which the lender was aware at the time of the loan and is considered by the lender in its assessments and in subsequent monitoring and supervision. By itself, a failure to repay on a single loan, though unfortunate, is a normal occurrence, the possibility of which was anticipated by the lender and included in its interest rate setting.

Some financial transactions, such as foreign exchange trades, swaps, and futures differ from simple transactions by creating future obligations for both parties to the transaction. More significantly, the outcomes for some participants may depend on the behaviour of others with whom they have no direct dealings. This dependence occurs because some financial market transactions take place, not through the one-on-one arrangements that characterize most trades, but through arrangements that include simultaneous and continuing bilateral arrangements between one party and many other counterparties or through multilateral networks, where many parties interact.

Arrangements involving exposure to the actions of third parties may arise because such a network architecture is vital for some financial activities. In the trading of stocks and derivatives, networks offer an enlarged pool of parties with whom to transact and thus result in lower search costs or transactions costs. In securities markets, this greater scope improves the prospect of achieving better terms. In payments systems, a network expands the number of others with whom users or their customers can settle.

Network members depend on others for more than simple transactions where the parties can limit their exposure to a single counterparty. A network's effectiveness depends on each participant being able to deal with any of the others. But network participants have a weaker incentive to investigate their counterparties than they would in two-party transactions. Participants in two-party transactions reap the greatest benefit from their efforts in assessing and monitoring. The very operation of multi-party networks can remove these benefits. Some interactions may be both sufficiently infrequent and unpredictable in timing not to warrant the effort of assessing and screening. Instead, participants may free ride on the efforts of others. The more inclined members are to do this, the more they will be exposed to greater uncertainty than they would in bilateral transactions.

Financial institutions illustrate arrangements where a single party deals with many counterparties at the same time. They offer deposit or other liabilities (many of which are fixed claims payable on demand) to a broad range of customers, and they serve as agents on their behalf by assessing, supervising, and monitoring the opaque and illiquid investments and loans that stand behind their deposits. In doing so, they effectively transform the liquidity of assets by issuing liquid (short-term) deposit claims backed by illiquid (long-term) assets. Financial institutions can make these transformations only to the degree that they maintain their customers' confidence in their ability to honour their deposits. The outcome for depositors depends, as in ordinary two-party transactions, on the actions of the financial institution as the other party to the transaction. It differs, however, because it also depends on the actions of other depositors. If enough depositors lose confidence in the claims of financial institutions, this loss of confidence becomes a self-fulfilling expectation. Since a bank's liquid assets are limited, and its illiquid assets are not acceptable for meeting claims, depositors must anticipate not only the actions of the financial institution itself, but the actions of other depositors, because only those near the head of the line can succeed in withdrawing their funds if their institution suffers a loss of customer confidence.

Depositors at financial institutions and participants in financial networks consent, either explicitly or tacitly, to the other parties to whom they will be exposed. A more extreme possibility is that participants in financial markets can be harmed by the actions of others with whom they have no dealing at all—direct or indirect. The conditions in which financial institutions pressured by deposit withdrawals can dispose of their illiquid assets will depend on the number of other institutions attempting to do the same, which in turn, depends on the confidence of their depositors. A pressured institution faces less-favourable terms for a disposal of assets when other institutions are also pressured to sell. The lower prices for illiquid assets further diminish the value of the institution's remaining holdings and, hence, its ability to meet its obligations. Thus, pressures shared by financial institutions can be spread and magnified by the way in which they dispose of assets.

Participants in financial markets also depend on the framework that governs the operation of these markets. This framework may take the form of laws or commonly understood codes or rules of behaviour that govern transactions. It may also be in the even less-tangible form of public faith in the workings of the financial system or its components.

The need for financial institutions to maintain the public's confidence in order to survive can create an interdependence among them. Financial institutions that manage risk prudently can be harmed if the public revises its view of the soundness of a group or class of institutions, or even all institutions, on the basis of its perception of other, less-prudent institutions.

The linkages among participants in financial markets arising from networks, the inherent structure of banks and other financial institutions, and the common reliance of institutions on markets for liquidity all contribute to the so-called "systemic risk" that has often been identified as a key feature of the financial sector. These relationships can cause pressures on banks and on the rest of the financial system that may be neither random events nor confined just to those institutions first hit by a particular shock. These linkages can lead to episodes where clusters of banks simultaneously face common pressures, which may even be independent from any common vulnerability they share. Systemic risk refers to the possibility that pressures which initially affect one bank, or a few banks, can spread to affect other elements of the financial system and, if sufficiently severe, can jeopardize the stability of the entire system. The spreading of pressure results from the shared need of banks and other financial institutions for public confidence and their reliance on the same markets as sources of liquidity.

4. The Costs of Financial Instability

The costs of financial instability come from the detrimental impact that an unstable financial sector has on the economy. Increasingly, evidence suggests that the functions performed by the financial sector are vital to an economy's economic growth (Levine, Beck, and Laoyza 2000a and b). These include its intermediary and payments functions (Box 1). Any examination of the costs of financial instability should therefore focus on the ways that instability affects the financial sector's performance of these key functions.

As discussed earlier, financial instability differs from the continual normal changes taking place in financial markets because of its effect on the economy's performance. Financial instability is not an all or nothing condition; it has gradations. A financial crisis is an extreme degree of financial instability, where the pressures on the financial system are sufficient to impair its function significantly over a prolonged period. But financial systems can be subject to stress well before a crisis takes hold. The costs and consequences of financial instability depend upon the degree of stress. The difference in these costs for differing degrees of stress can be qualitative rather than just a question of size. While financial instability, like other sources of macroeconomic instability, directly affects current employment and output, the consequences of financial instability for the longer-run growth of the economy may be at least as great a cause for concern.

Box 1

The Key Functions of the Financial System[1]

The ***intermediation function*** of the financial sector brings resources accumulated by savers to investors who have identified productive uses for them. While some resources are transferred directly between savers and investors themselves in direct markets, the bulk of these transfers occurs indirectly through various intermediaries, such as commercial and savings banks and mutual funds, that collect resources from savers and make them available to investors.

The ***payments function*** of the financial system is more closely identified with banks. They provide the most important means by which individuals and businesses carry out the payments arising from their other transactions. In providing this function, the banks must be able to make payments among themselves to satisfy the obligations arising from their customers' trade. At the centre of these payments activities are the clearing and settlement arrangements through which banks exchange and compensate each other for claims arising from the payments made by their customers.

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[1] The functions through which the financial system contributes to the economy have been enumerated by Crane and Bodie (1996). Those described here are a condensation of their list.

Many types of shocks increase financial stress. Sharp declines in asset prices, in property markets, or in the stock market have frequently caused increased financial stress in developed economies. These changes can weaken the financial condition of households and businesses. To the extent that the financial conditions of their borrowers deteriorate, such shocks can also weaken the condition of banks and other financial institutions. This will lead to higher market interest rates as investors look for greater returns because of their perception of greater risk.

Market participants react to normal changes in financial conditions in ways that can be absorbed by markets without harming the fabric of the financial system. A moderate shock will weaken the conditions of households, businesses, and even financial institutions. Higher interest rates resulting from financial stress can harm the short-run profitability of businesses and the well-being of some households and governments by increasing their costs of carrying debt. In most cases, once financial conditions are reversed, the financial health of most institutions, enterprises, and households will be restored. In other cases, however, the weakened financial conditions and the higher medium- and longer-term corporate interest rates will be the "straw that breaks the camel's back" by revealing the unsound financial conditions of some institutions, businesses, and households. The activities of the unsound businesses that fail will, in the normal course of events, be replaced with relatively little disruption by the emergence of new enterprises and the growth of existing ones. This turnover is a normal part of the functioning of a market economy and is only accelerated by moderate financial stress.

Shocks of different sizes have qualitatively different impacts. A modest deterioration of the financial conditions of enterprises causes banks to reduce or withhold further credit until conditions are reversed, leading to just the postponement of expenditures. The repercussions become greater with larger changes. A larger shock can weaken the condition of borrowers to the point of their being unable to meet their interest and repayment obligations and placing them in default. If widespread, such defaults, by leading to changes in the behaviour of financial institutions, could impair the ability of all enterprises to gain external financing over a prolonged period, thus delaying the economy's recovery from the shock. Continued far enough, the deteriorating conditions can even bring financial institutions themselves into default, when borrower defaults make them unable to meet their own obligations. The impaired condition of financial institutions may limit their ability to provide credit, restricting financing flows even to those enterprises unaffected by the initial shock. Under these conditions, the consequences of a substantial shock are not just a simple extrapolation of the effects of a moderate one.

The immediate costs of financial instability arise from the breakdown of the financial system's ability to perform its functions. Part of this breakdown will take place in the immediate area of the initial shock. Experience with bad loans and the weakened condition of borrowers may make financial institutions less willing to provide new loans. They may also restrict credit to their existing borrowers or charge them higher interest to reflect their perception of heightened risk. The possible failure of counterparties in the payments and clearing system may lead to greater caution among participants, causing them to limit lines of credit to other participants or to require higher collateral. Transactions previously treated as routine may be delayed on a discretionary basis. Disappointed expectations may cause users of the payments system to seek alternative ways to make payments. But the costs of a financial crisis need not be confined to the proximity of its source. In the aftermath of a systemic shock, the pressures will spread to other parts of the system, impairing their ability to perform their normal functions. For example, the effects of a failure in foreign exchange settlements may create settlement problems in a domestic payments system. In turn, any resulting deterioration of the condition of financial institutions could limit their ability to continue financing business activity. In the extreme, financial instability could lead to systemic failure, where key parts of the financial system as a whole break down and cannot fulfil their functions effectively.

The duration of the impact also depends on the scale of the shock. Slowdowns in production and employment brought about by modest shocks can be readily reversed when conditions improve. For larger shocks, the financial condition of businesses may be too weak to attract the funding needed to reverse their production cutbacks. Recovery for these enterprises may take place only after they have strengthened their balance sheets or, if bankrupt, after they have been reorganized or placed under new management. The recovery will be further prolonged if the shock impairs the condition of financial institutions. In extreme cases, the difficulties of financial institutions may erode depositor confidence. Then, a return to normal financing conditions may require a rebuilding of confidence, which is likely to proceed only gradually. Such changes may impose enduring costs on the economy because, as Stiglitz observed, "social and organization capital turns out to be fragile—and like Humpty Dumpty—hard to put together again" (Stiglitz 1999, 48).

The impact of a shock also depends on prevailing conditions. The same shock will affect businesses differently, according to their financial condition at the time of the shock. Clearly, solvent enterprises that have substantial liquidity will be better able to weather the impact of a shock than others because they can readily meet claims for any required payments facing them, and their clear solvency will reassure lenders. The impact of a shock will also depend on the condition of the financial sector. Strong financial institutions can maintain their soundness in the face of borrower defaults. Enterprises will also be able to turn to direct markets to issue bonds and other securities to the degree that the capital market institutions remain in good condition.

Finally, the impact of a marked change in financial conditions will also depend on the degree and kind of institutional development. The impact of a shock on business enterprises can be mitigated; for example, if there are clear provisions for bankruptcy proceedings. These can reduce the prospect of a race to the exits by lenders, because security provisions give some degree of protection, and orderly workouts can avoid production shutdowns or hasten the resumption of interrupted production. Similarly, risk-proofing of clearing and settlement sytems, lender-of-last-resort activities, and deposit insurance all mitigate the effects of financial shocks. The effects of a change in financial conditions may also be dampened by a monetary policy response if the shock, in aggregate, is large enough.

5. A Role for Policy?

Financial instability certainly poses a threat to the effective workings of financial institutions and markets and may be costly when it occurs. But does this justify public policy for its prevention, containment, and cure? Any case for the adoption of policies to prevent and overcome financial instability must be based on its superiority over doing nothing; i.e., remaining passive in the face of financial instability and failing to design institutions and policies to limit the prospects of instability. While expressions such as "collapse" and "meltdown" often characterize discussions of financial instability, such language offers little guidance with respect to its consequences. Since financial systems can operate (and indeed have operated) in the absence of policies to prevent and contain financial crises, the key question becomes, how would they function differently if policy actions were directed to this objective?

Financial stability is fostered by an environment in which investors face minimal uncertainty with respect to financial conditions. Experience during the 1970s and 1980s in developed economies showed that higher inflation brought greater variability of inflation that, in turn, produced greater volatility in interest rates and other market conditions. Along with other adjustments, suppliers and users of funds responded by shortening the maturities of their obligations to avoid being locked into unfavourable terms as market conditions changed. The pursuit of low and stable inflation can reduce an important source of uncertainty for decision-makers in financial markets. Over the longer run, the goals of financial stability and low and stable inflation appear to be compatible and even mutually supportive.

The absence of appropriate policies for financial stability will lower the credibility of the financial system in the eyes of the public. Economic players, including consumers, businesses, and financial enterprises will all be affected by, and will, in turn, respond to, the possibility of financial instability. They will compensate in various ways.

At one time, households protected themselves from instability by holding more currency relative to their claims on financial institutions. Now, they may also insulate themselves from instability by holding substantial liquid assets relative to riskier assets, such as equities and corporate bonds; by holding lower-risk government securities; and, at the same time, by shortening the maturity of their assets. They may also try to maintain low debt levels relative to their assets and income. Business enterprises minimize their vulnerability to instability in similar ways. They too would hold higher liquidity and maintain low levels of debt, making them less dependent on the availability of financing. Possibly, the most significant differences in behaviour would be those of financial institutions. They would tend to lessen the market and credit risk of their portfolios by holding short-term assets with low credit risk such as bills and short-term bonds issued by governments at the expense of claims on the private sector.

Such behaviour from these diverse economic players would tend to limit the possibility of financial instability. Households and businesses would be less likely to generate shocks that initiate crises or to transmit and amplify shocks coming from elsewhere. Just as important, the conservative makeup of the portfolios of financial institutions would make them less vulnerable to risks initiated elsewhere.

It is difficult to speculate on the residual prospects of financial crises and their likely costs in such an environment. All participants might be sufficiently averse to risk that their adjustments would likely make the possibility of a financial crisis remote. But their behaviour would imply a very different flow of funds through the financial sector than if public policy was perceived to be guarding against financial instability and to have put in place provisions to this effect. The response of households would affect the form of their saving and its availability for financing, since they would be less likely to provide financing directly to enterprises. Moreover, even though this reluctance to provide direct financing would be reflected in more indirect financing through intermediaries, its character and quality would be different, with more willingness to fund government and less willingness to fund private industry. The pressures on households to maintain their liquidity, together with financial institutions' own tendencies to avoid risk, would change the quality of the financing they provide. They too would emphasize shorter-term, lower-credit-risk investments, when faced with concerns about financial stability.

These protective responses against financial instability would come at some expense to the economy. Even without any change in saving behaviour, the flows of funds through the financial sector would have been altered in character. Under normal conditions, enterprises require secure funding in order to make longer-term commitments. This tendency would be accentuated in the face of the risks of financial instability. At the same time, savers and intermediaries would themselves avoid longer-term riskier commitments. The consequences of such responses would, in fact, resemble the reactions to financial crises. Thus, the effectiveness of the financial system in transforming its claims on businesses into financial assets acceptable to ultimate savers would be diminished. These responses would reduce the effectiveness of the financial sector in performing its functions, which are vital to an economy's performance.

Clearly, financial systems could operate, and have operated, in environments that lack policies directed at financial stability. Such an absence may come at a substantial cost. A financial system in these circumstances may not be as deep and broad in its functioning as one with safeguards that limit the frequency and the degree of financial instability.

6. The Role of Central Banks in Financial Stability

6.1 Policy for financial stability

Governments and their agencies act to limit financial instability through a variety of policy measures.[5] **Preventive** policies are anticipatory measures taken to reduce the potential costs of financial instability by making it less likely to occur or by minimizing the damage when it does occur. Among such preventive measures are a sound legal infrastructure applying to financial transactions, the framework of prudential regulation governing banks and other financial institutions, risk-proofing measures for the clearing and settlement arrangements for payments, securities, and foreign exchange, and the provision of deposit insurance. **Containment** policies are measures that can be taken to reverse or overcome the severity of financial instability as it is occurring. These include the central bank's lender-of-last-resort facility, which protects otherwise solvent institutions from a shortage of liquidity. In addition, prompt action to deal with weak institutions may also limit the losses from instability. **Remedial** measures are used to minimize the costs arising from financial instability after it has occurred. Remedial measures include restructuring distressed institutions through recapitalization, mergers with healthy institutions, and the installation of new management. These measures are directed towards reducing the costs of financial instability arising from impairment of any part of the financial system in performing its function.

6.2 What can a central bank contribute?

In any developed economy, there are a number of agencies whose mandates overlap with respect to the objective of financial stability. Bank supervisory authorities are responsible for inspecting and monitoring the safety and soundness of individual banks—a key to the prevention of financial instability. These authorities and others are also active in containment through prescribing remedial actions for financial institutions in doubtful condition and recommending, or even carrying out, the closure of institutions that have inadequate capital and whose solvency is in doubt. Similarly, deposit insurers offer protection to depositors that contains the spread of pressures from unsound institutions to other parts of the financial system. They may also set standards for financial institutions to qualify for coverage. Market regulators, such as securities commissions, also have a role in financial stability through setting rules that establish a framework to avoid the initiation of financial crises in and to restrict their propagation through financial markets. Finally, ministries of finance generally develop, coordinate, and oversee the preventive legislative and regulatory framework that governs much of the financial sector, especially the major financial institutions that are a substantial part of the sector. All these agencies are part of a defence system against instabilities beginning in, or transmitted through, the financial system.

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[5] The three dimensions of policy can be compared with the "crisis prevention" and "crisis management" approaches described by Powell (2001). His management function includes both the containment and remedial measures identified above. The distinction between the two aspects of management may be less important for international crises, because countries do not go bankrupt in the same way as financial institutions.

While central banks have traditionally played a variety of different roles in the economy, over the past decade or so they have increasingly focused on the pursuit of low and stable inflation. Given this identification with price stability and the active presence of other agencies identified with financial stability, do central banks have any further role in preventing financial instability?

One role for central banks in promoting financial stability flows from their unique position: only their liabilities are the ultimate domestic liquidity in any country's financial system. Central to any financial crisis is a general scramble for liquidity, and as Bagehot recognized some 150 years ago, central banks, as the ultimate providers of liquidity, may be able to temper the force of financial shocks by meeting heightened public demands for liquidity.[6] This role of central banks is one of containment: they react when signs of financial pressures become apparent. In addition, the presence of central banks in their role as lender of last resort may in itself be sufficient to reduce the likelihood of crises.

Some central banks have explicit responsibilities for financial stability going beyond their role as ultimate provider of liquidity. The Payment, Clearing and Settlement Act gives the Bank of Canada responsibility for the oversight of key clearing and settlement systems that settle on the books of the Bank and that may pose systemic risk. As part of this responsibility, the Bank has the power to designate those systems that may pose systemic risk, and to subsequently oversee those systems. The Bank's role here provides an additional reason for its broader involvement with financial stability. These responsibilities, however, are themselves largely derived from the Bank's distinctive ability to provide liquidity and to provide risk-free assets for system settlement. Payments and settlement systems are at the core of the financial system and are therefore the focus of liquidity pressures created elsewhere.

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[6] Bagehot declared "We must keep a great store of ready money always available, and advance out of it very freely in periods of panic, and in times of incipient alarm. . . . Any notion that money is not to be had, or that it may not be had at any price, only raises alarm to panic and enhances panic to madness." See *The Collected Works of Walter Bagehot*, vol. 9, N. St. John-Stevas (ed.) (London: *The Economist*, 1978), p.75.

6.3 A shared responsibility

So far, the central bank's role in financial stability has been discussed in terms of containment once the threat arises. Yet containment is only one dimension of the policy response to financial instability. Policy-makers must also be concerned with prevention. Do central banks have a particular interest or stake in the preventive dimension of policy?

A case can be made for central bank involvement on the basis of both their function as lender of last resort and their particular responsibilities for designated clearing and settlement systems. In a sense, these functions are very closely linked. Their role as lender of last resort is an important element in the defence against the instability of institutions at the core of the payments system. Moreover, as shown in Illing's essay, the liquidity needs to support the functioning of the payments system can be enormous and can arise suddenly.[7] As a result of their responsibility for dealing with these shocks, central banks have a direct concern with the environment in which these shocks are initiated and propagated. They must also develop operational expertise, especially with respect to monitoring the operations of the payments system. This expertise should be a valuable input when planning an appropriate institutional framework, especially with respect to cushioning the payments system from shocks and developing short-run responses for containing any instability that occurs.

Central banks also have responsibilities that are quite different from those of the other agencies involved in financial stability. They must, to a far greater degree, develop a broad knowledge of the economy and of current economic conditions in order to form their judgments in setting monetary policy. They must also understand the workings of financial institutions and markets because these are key channels through which monetary policy has an influence. Finally, instability can drastically affect the conditions in the financial sector for any policy setting. Thus, central banks must be aware of the sources of instability and must continually monitor the current state of the financial system in order to set monetary policy appropriate to their macroeconomic objectives. These particular perspectives, especially the broader economy-wide perspective, allow the central bank to make a distinctive contribution in managing financial instability when it happens and in planning its prevention.

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[7] In his essay, Mark Illing describes an episode in which the Federal Reserve Bank of New York advanced over US$20 billion overnight credit to the Bank of New York to prevent a computer failure from paralyzing a major part of the U.S. payments system.

7. Challenges of Financial Stability Policy

7.1 Accountability and conduct

Over the past 20 years, the conduct of monetary policy has evolved from being a less than precise, opaque "art" towards a more open and systematic "practice." This change has been reflected in both the conduct of monetary policy and in the accountability of central banks. Many of the changes have been possible because monetary policy has become more focused on the pursuit of an announced objective of price stability over the medium term. Central banks have also accepted clearer responsibility for a more closely defined set of goals and have conducted their policies more visibly.

The central bank's role with respect to financial stability poses some quite different issues of conduct and accountability than does monetary policy. For example:

- Financial instability is a low-probability event with high costs.
- The low probability of crises means that experience in dealing with them will be limited.
- The onset of financial instability can be sudden and severe, requiring a quick response.
- Different parts of the financial system may be vulnerable to instability in different ways.
- Rapid and widespread changes in financial markets and in the behaviour of financial institutions have created new financial products and new ways of doing business that, in turn, lead to different sources of instability than have been encountered in the past.
- Instability tends not to be systematic.

The performance of central banks with respect to macroeconomic stability can be transparent and continually assessed, because macroeconomic performance measures are available regularly and frequently. For example, interest rate data are continually available through the operation of markets, while other measures such as price indexes and output measures are available monthly and quarterly. The performance of central banks and other authorities concerned with financial stability, in contrast, is directed towards the avoidance of low-frequency, high-cost events. Performance criteria include the degree to which central bank policies have reduced the likelihood of crises and the scale of costs should a financial crisis occur. The absence of financial instability is a normal state and can persist for long periods. The status of this stability could be enduring and robust, or temporary and fragile, with even the last consistent with long spells of apparent stability. The effective or inadequate performance of central banks may be undetectable until a crisis materializes. Central banks themselves face uncertainty with respect to the adequacy of the measures that they and others have taken to prevent financial crises or to contain them when they occur. Overseers of central banks also have little basis for judging their performance. As in the case of fire departments, it is not the absence of fires alone that reveals their quality, but also their response when fires break out. So too, periods of financial stability will not by themselves give an adequate picture of a central bank's performance.

The low probability of its occurrence also poses problems in dealing with financial instability when it does take place. Given its infrequency, authorities and observers have had less opportunity to understand its qualities in terms of its sources and the ways in which it is propagated. Thus, at least with the present state of knowledge, the approach taken to the containment of financial instability may need to be more responsive to the particular characteristics of the situation and less systematic than central banks' more measured conduct of normal monetary policy.[8] This need for responsive approaches to containment becomes reinforced by the nature of episodes of financial instability: their onset often takes the form of sudden and sharp shocks that certainly warrant their description as "financial crises." Under such conditions, the measured policy approaches suitable for achieving price stability may be unsuitable. Central banks may be forced by the turn of events to respond to the symptoms promptly before all dimensions of the problem can be adequately assessed.[9]

The limits to the understanding of financial instability flowing from its infrequency are further aggravated by the complexity of the financial system. Its components are not homogeneous: they consist of varied elements that differ in function, in institutional structure, and especially in terms of their vulnerability to various sources of instability. These elements include payments systems, and the markets for securities, foreign exchange, and derivatives, together with their associated clearing and settlement arrangements. They are also linked to varying degrees through institutions such as banks and investment houses whose activities span many elements. All of these can, in one way or another, be vulnerable to shocks. Despite past experience, each new financial crisis still manages to bring its own elements of surprise.

The varied nature of instability also arises from the experience of dealing with past crises. Given the perceived high costs of financial instability, those responsible for preserving stability can be

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8. Indeed, the Bank of New York episode described by Illing and the situation precipitated by Herrstatt Bank's failure to settle its foreign exchange obligations—the episode that kindled renewed central bank concern with financial stability in the mid-1970s—both represented the appearance of previously inexperienced types of instability.

9. The Long-Term Capital Management crisis was one occasion where the Federal Reserve Bank of New York responded quickly to indications of possible failure that might cause considerable damage to an already vulnerable and fragile world financial system. The President of the Federal Reserve Bank of New York declared "The abrupt and disorderly closeout of Long-Term Capital's positions would pose unacceptable risks to the U.S. economy" (McDonough 1998). Furfine (2001), however, suggests on the basis of his research on patterns of interbank lending at the time, that "the market never believed that [the 9 major creditors of LCTM] . . . had a significant probability of default" (p.12).

expected to respond to actual and threatened instability by reforming institutions and developing new tools based on this experience. When successful, such an approach has the benefit of reducing the frequency and severity of similar episodes in the future. At the same time, however, it tends to ensure that future crises will be unlikely to resemble those encountered in the past. The varied character of recent episodes of financial instability or threatened instability discussed in Illing's essay amply illustrate this point.

Finally, dealing with financial instability has also become complicated by the rapid pace of change in financial markets and financial institutions arising from globalization, the continuing emergence of new products and techniques resulting from advances in information and communications technology, and the elimination of former distinctions among different types of financial activity through deregulation. New financial products and services, even those intended to manage risks, may have significant side effects that create new ways in which risks may manifest themselves or be distributed.[10] Similarly, increased financial activities across national borders expose financial market participants to new and different sources of risk. Improved communications and the closer linkages of markets may also speed up both the emergence and the transmission of financial crises.

These arguments for responsiveness to the specific nature of individual crises are based on short-run considerations. In the longer run, there is greater scope for more general preventive measures. Even though the sources of financial pressures may be difficult to anticipate, it is possible to identify sources of vulnerability in the financial sector and to take corrective action. While some discretion may be required in response to any episode of instability, the scope of the discretion can be limited, in the knowledge that specific parts of the system are insulated from the pressures. Over time, experience with periods of stress can allow the refinement of the preventive dimensions of policy, reducing the urgency for responsive measures when problems do arise.

7.2 The liquidity dilemma

At the heart of a central bank's function of providing liquidity to contain financial crises lies an inherent dilemma. Timely provision of liquidity can bolster the public's confidence in the condition of financial institutions and markets. In addition, liquidity needs can generally be met at lower costs through arrangements involving central banks than through each financial institution managing their liquidity in isolation. At the same time, centralized provision of liquidity weakens the resolve of financial market participants to avoid exposure to liquidity risks. Both financial institutions and their customers may become less vigilant in avoiding these risks if they perceive that central banks will supply them with liquidity in times of crisis. Central banks must then be heedful of the fact that access to their liquidity can increase the probability of the events that it was intended to avoid. This dilemma raises vital questions about the terms and conditions under which central banks should provide emergency liquidity to the financial system and whether such liquidity should be directed towards markets in general or to the specific institutions facing liquidity problems.

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[10] The description of Long-Term Capital Management as a hedge fund suggested that it was intended to shield its investors from risk, which was far from being the case.

7.3 Financial stability and other policy goals

As discussed earlier, financial stability poses different policy challenges than other major central bank objectives, especially the maintenance of low and stable inflation. There is also the possibility that the pursuit of financial stability may at times conflict with the conditions needed to achieve the central bank's macroeconomic goal of low and stable inflation.

While financial and price stability tend to be compatible in the long run, a short-run conflict between financial stability and the central bank's price objective could occur if pressures on the financial sector made it necessary for the central bank to depart from the path of short-term interest rates consistent with its inflation target. This possibility could arise when parts of the financial sector are under stress, require more liquidity, and are vulnerable to increased interest rates, while upward price pressures call for higher-than-normal market rates. While such a conflict may be possible, its likelihood and seriousness will be mitigated by a number of factors under normal conditions. A mild degree of financial stress may produce pressures for the central bank to provide liquidity to individual institutions but, otherwise, have little effect on general market conditions. In this case, the central bank can readily offset any intervention it undertakes to provide support for these institutions by simultaneously reducing the size of other assets on its balance sheet in order to withdraw liquidity and maintain the policy stance called for by macroeconomic conditions.

More widespread financial stress could alter financial market conditions themselves. Institutions affected by the stress might respond by limiting their supply of credit, causing a general tightening of market conditions. The financial stress and a resulting greater perception of risk could lead to generally tighter market conditions. Financial stress may also weaken the balance sheets of households and businesses and, as a result, threaten to curb their spending, weakening the economy and pushing inflation below its target. In these cases, a lowering of the target interest rate by the central bank may be compatible with both its financial stability and macroeconomic goals.

In the face of recent threats to financial stability, central banks have readily provided extra liquidity over the short run. Examples include the operational failure of the Bank of New York (1985); the stock market crash of 1987; the Long-Term Capital Management crisis of 1998; and the 2001 attack on the World Trade Center in the United States. In each case, the central bank provided generous liquidity support to the financial system and then withdrew it, sometimes over days and sometimes over weeks, as the threat subsided. In each case, these injections of liquidity proved to be sufficiently short-lived that they did not jeopardize the central bank's inflation objective.

The threat of conflict will be greater if the central bank allows inflationary pressures to become excessive. In this case, the required monetary tightening could create substantial pressures on the financial system, worsening the financial conditions of households, businesses, and financial institutions if they are already fragile. Such concerns may cause central banks to delay or ease their response to signs of strengthened inflation pressures. The conflict would be more apparent in the face of a possible crisis. Then, threats to the financial stability might require the central bank to provide the system with substantial liquidity to restore confidence.

The possible conflicts between these key goals could lead to difficult choices for central banks. In dealing with these conflicts, it should be recognized that both financial stability and low and stable inflation are, in a crucial sense, just intermediate goals. Each has its status as a central bank objective solely through its contribution to a higher-level objective, the public's economic well-being. But at times, the two goals may involve different time horizons, and in making their choices, policy-makers must try to balance the costs of temporary departures from price-stability targeting against the longer-run damage arising from an unchecked financial crisis. This problem can be minimized by the adoption of a transparent approach to monetary policy, under which the central bank's objectives and the horizons for their attainment are communicated and well understood and given credibility by the central bank's performance. Such an approach will strengthen the incentives of households, businesses, and financial institutions to manage their affairs in light of the central bank's approach. Just as important, the central bank's ability to pursue its policy objectives can be strengthened by the existence of a regulatory framework that supports the strength of the financial sector and by the resolve of regulators to deal with weak institutions through remedial measures or even closure where warranted.

7.4 Financial stability and efficiency

Increasing evidence has accumulated in recent years showing that an efficient financial sector contributes to an economy's performance. In addition, many argue that the efficiency of the financial system is best served by a minimal regulatory framework. Policy-makers may thus appear to be confronted by a policy conflict between financial stability and the efficiency of the financial sector.

The tension between the goals of stability and financial market efficiency appears greater than it actually is and can be largely resolved through taking a longer-run perspective. Regulations in support of financial stability will certainly restrict the actions of financial institutions in the short run. Such regulations will, in effect, inhibit or alter flows through the financial system compared with what might have happened in their absence. But to a degree, this comparison is incomplete if one considers only the short-run trade-off between efficiency and stability. In effect, it assumes conditions of financial stability that themselves depend on the presence of prudential regulation. In its absence, the apparent trade-off may, at best, last for only a short period.

In the longer run, prudential regulation in support of financial stability may lead not only to larger flows through the financial sector, but also to flows that are better suited to the needs of those seeking financing. Over the longer run, financial stability and efficiency will be more compatible than in the short run. Indeed, an appropriate degree of regulation directed towards financial stability can reinforce, rather than detract from, financial market efficiency.

There still remains a need to strike an appropriate balance with respect to financial stability in the longer run. Too little protection could lead to a fragile financial system unable to engender public confidence; too much can stifle financial sector initiative. Stability should be achieved with the lowest regulatory burden, whatever the degree of stability chosen. Given the low frequency of financial instability and our limited knowledge of the effects of regulation, it is not easy to assess whether the appropriate balance has been struck.

8. Conclusion

The pursuit of financial stability has emerged to become a significant economic goal of more and more central banks. The role of central banks with respect to financial stability flows from their unique ability to provide liquidity, their responsibility for the security of key elements of the payments system, and their economy-wide perspective. The involvement of central banks with financial stability raises very different issues with respect to the conduct of policy and central bank's accountability for their policies than their increasingly systematized pursuit of price stability. Despite the historic roots of financial stability as a central bank objective, further research is needed on the ways it should pursue this objective in today's world. As in the case of macroeconomic policy, central banks must be transparent and accountable. Such accountability will require broader public understanding of financial instability and the issues it raises.

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Appendix

Table A1: Episodes of Systemic Banking Crises: Industrialized Countries

Country	Period	Scope of crisis	Resolution costs
1. Systemic crises			
Finland	1991–94	Savings banking sector badly affected; Government took control of three banks that accounted for 31 per cent of total system deposits.	Recapitalization costs amounted to 11 per cent of GDP.
Japan	1990s	Banks suffering from sharp decline in stock market and real estate prices through 1990s. Estimate of non-performing loans: 87.5 trillion yen (US$725 billion) in 1995 (17.9 per cent of GDP).	By mid-1999, recapitalization costs estimated at 15-20 per cent of GDP
Norway	1987–93	Central bank provided special loans to six banks and took control of three largest banks (equivalent to 85 per cent of banking-system assets) partly through Government Bank Investment Fund and state-backed Bank Insurance Fund.	Recapitalization costs amounted to 8 per cent of GDP.
Spain	1977–85	1978–83: 52 institutions rescued, liquidated, merged, or nationalized, representing 20 per cent of all banking-system deposits.	Bank losses estimated to be equivalent to approximately 16.8 per cent of GNP
Sweden	1991–94	Two banks, accounting for 21.6 per cent of banking-system assets, declared insolvent	Recapitalization costs amounted to 4 per cent of GDP.

(continued)

Table A1: Episodes of Systemic Banking Crises: Industrialized Countries

Country	Period	Scope of crisis	Resolution costs
2. Borderline crises			
Australia	1989–92	Two large banks received capital from government to cover losses.	
Canada	1983–85	Fifteen members of the Canada Deposit Insurance Corporation failed.	
Denmark	1987–92	Cumulative loan losses equal to 9 per cent of loans; 40 of 60 problem banks merged	
France	1994–95	Credit Lyonnais	Unofficial estimates put losses at about US$10 billion
Germany	late 1970s	So-called Giro institutions faced problems.	
Great Britain	1974–76	"Secondary Banking Crisis"	
Great Britain	1980s and 1990s	Notable bank failures	
Greece	1991–95	Localized problems that required significant injections of public funds into specialized lending institutions	
Iceland	1985–86	One of three state-owned banks became insolvent and eventually privatized in a merger with three private banks.	
Iceland	1993	Government forced to inject capital into one of the largest state-owned commercial banks after it suffered serious loan losses	

(continued)

Table A1: Episodes of Systemic Banking Crises: Industrialized Countries

Country	Period	Scope of crisis	Resolution costs
Borderline crises (cont'd)			
Italy	1990–95	58 banks (accounting for 11 per cent of total lending) merged with other institutions.	
New Zealand	1987–90	One large state-owned bank, accounting for one-fourth of banking assets, experienced serious solvency problems because of high non-performing loans.	The bank required a capital injection equal to one per cent of GDP.

Source: Adapted from Caprio and Klingebiel (1999).

Table A2: Selected Events Affecting Canadian Financial Markets

Date	Event
1982	**LDC debt crisis** Mexico, Brazil, Argentina, Hungary, and Yugoslavia receive IMF interim bridge financing. Canada contributes US$250 million loan. IMF increases country quotas by 47.5 per cent to cover mounting costs; international commercial banks are highly exposed to bad debts. Debt write-offs
1985	**Canadian regional bank failures** Bank of Canada facilitated the meeting that led to the $255 million support package to the Canadian Commercial Bank (CCB) by banks and governments in March. The Bank provided liquidity to both CCB and Northland. Eventually Bank of Canada made combined advances of Can$1.8 billion to these troubled banks, as well as loans to other banks that found it difficult to retain sufficient deposits to fund their outstanding loans. CCB and Northland enter insolvency in September 1985.
1985	**Second LDC crisis** Canada contributes short-term bridge financing to Argentina, Mexico, and Nigeria, who cannot meet their debt obligations; Baker initiative coordinates debt rescheduling.
1987	**"Black Friday"** TSE crashes 17 per cent in two trading days (parallels U.S. crash)
1990–92	**Real estate price collapse** Average residential house price falls $20,000, and commercial property prices fall almost 40 per cent over the next six years, leading to the collapse of Olympia and York, one of Canada's larger commercial property holders and an investor in similar assets outside Canada. Canadian banks and trusts suffer large loan losses as a consequence.
1992	**Royal Trust Merger and Failure of Sovereign Life**
1994	**Confederation Life failure**
1995	**Mexican crisis** Mexican bond spreads soar to almost 2500 basis points over U.S. Treasuries
1997	**Asian financial crisis** Begins with Thai Bhat devaluation and spreads to Malaysia, Indonesia, South Korea, and the Philippines

(continued)

Table A2: Selected Events Affecting Canadian Financial Markets

Date	Event
1998	**Russian/LTCM crisis** Russia defaults on debt, emerging-market bond spreads soar to 1700 basis points above U.S. Treasuries. Long-Term Capital Management, a highly leveraged hedge fund, sustains massive losses. The New York Fed arranges a creditor bailout.
2001	**Terrorist attacks** in the United States Bank of Canada announces provision of extra liquidity in payments and settlement system.

Financial Fragility: A Survey of the Theoretical Literature

Alexandra Lai

1. Introduction

Recent financial crises in Latin America, East Asia, and Russia have revived interest in the causes of financial instability. These crises also revealed gaps in our knowledge about the origin of financial instability and the development of financial crises. The size and frequency of such crises over the last few decades have underscored the importance of understanding the dynamics of financial crises both for their prevention and containment. This essay reviews the current state of knowledge and examines the approaches that have assumed an inherent instability in domestic financial systems and that have investigated the sources of that instability.[1]

Financial crises are complex phenomena. There is an ample body of descriptive literature on the incidence of financial crises and plenty of data gathered from these experiences. Some characteristics of financial crises are presented in the next section. Because there is no conceptual (or natural) definition of a financial crisis, working definitions have been derived from the observations of events that have been commonly accepted as crisis episodes. These are more useful for classifying rather than understanding financial crises. In general, the descriptive literature does not yet shed much light on the underlying processes that drive financial crises. For this, we must turn to the theoretical literature.

Financial stability is defined as the ability of a financial system to resist a crisis following a given shock to the system. A financial crisis is the occurrence of a systemic event in the financial system

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[1] Although sharp declines in asset prices are often associated with financial crises, this essay does not examine the causes of asset market "crises," since the author views declines in asset prices as a trigger, albeit an important one, for financial crises, rather than as an underlying cause of financial instability. Models of financial crises based on moral hazard created by an ill-designed financial safety net (usually meant to deal with the inherent vulnerabilities of the financial system) are also excluded from this survey, since the focus is on inherent instability. Policy solutions to reduce the likelihood of financial crises and to mitigate the cost of crises when they occur must also take into account the possible perverse incentives for inappropriate and excessive risk-taking that a poorly designed safety net might encourage. There is a view among economists that recent financial crises in emerging markets have been caused primarily by poor financial sector policy and poor macroeconomic policies. For a good discussion of these issues, see Kaufman (1999).

"that will trigger a loss in economic value or confidence in a substantial portion of the financial system that is serious enough to . . . have significant adverse effects on the real economy" (Group of Ten 2001, 126). Hence, financial crises are manifestations of instability in the financial system that impose significant costs on the real economy. Systemic risk is the probability of such a crisis occurring.

Although financial crises are complex, each crisis can be broken into two components: initiation and propagation. *Initiation* pertains to the events that mark the beginning of a crisis, while *propagation* refers to the spread through the system of difficulties felt by individual financial institutions while a crisis is underway. A financial crisis may be initiated by the failure of one or several banks. A bank can fail not only because of insolvency, but also because it faces a shortfall of liquidity (when liquid reserves, consisting of cash and other liquid assets, fall short of the bank's current financial obligations) and is unable to obtain sufficient liquidity by borrowing from other banks or by selling its assets. The failure of solvent, but illiquid, banks implies a failure in the markets for liquidity on which banks rely to meet their short-term liquidity needs. By themselves, however, bank failures do not necessarily mean that a financial crisis is underway. In an uncertain world, firms and banks fail, and their activities are replaced without disruption by the entry of new institutions or by the growth of existing ones when the economy is functioning smoothly. Thus, bank failures can reflect the normal dynamics of a market economy. It is the other component of a crisis—propagation—that distinguishes individual bank failures from a financial crisis. Propagation occurs through *contagion* (a spreading of failures from one financial institution, or one part of the financial system, to another) and through the *financial accelerator*. The financial accelerator describes the feedback between business investment (and, hence, real output) and the cost of borrowing, which provides a channel through which financial events affect the real economy. The propagation of failures can impair the normal functioning of a financial system and, at the extreme, lead to a collapse of the system, resulting in significant real costs for the economy.

A financial crisis can be initiated by a run by depositors on a bank as a result of *coordination failure*.[2] A run on a bank occurs when the bank's demand for liquidity, owing to withdrawals by depositors, exceeds the short-term value of its assets. This can happen because banks' balance sheets exhibit *maturity mismatch*, which means that the banks' liabilities (composed predominantly of deposits) tend to be short-term and of fixed value, while their assets tend to be long-term and illiquid. One group of models in the literature focuses on how runs on banks originate, and identify coordination failure as the root of their vulnerability to runs. Section 3 reviews the explanations of how coordination failure can cause bank runs. Coordination failure can cause one bank or an entire banking system to fail. However, these approaches cannot provide a complete explanation of crises because, in the absence of linkages between banks in the form of information spillovers or credit exposures, whether a run occurs at a bank depends only on the decisions of that bank's depositors. It is only by coincidence that runs are experienced by several banks. Thus, these approaches explain only crisis initiation.

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[2] Coordination failure occurs when decision-makers, acting in their individual interests, produce an outcome in which each individual is worse off than they would be in the outcome where they acted in their collective interests.

When a bank's need for short-term liquidity exceeds its reserve of liquid assets, it can acquire liquidity by selling some of its long-term assets (usually at a loss), drawing on its deposits at other banks, or by borrowing from banks with excess liquidity. Hence, bank failures often involve the failure of markets to meet the liquidity needs of the distressed banks. The second group of models surveyed here focuses on markets for liquidity and investigates the circumstances under which such markets are ineffective. If these markets work properly, a solvent bank should never be illiquid, since it will be able to sell its long-term assets or borrow against its long-term assets to tide it over its liquidity problems. Banks with liquidity needs in excess of their liquid assets turn to markets for liquidity, while banks with excess liquidity have an incentive to lend to illiquid banks. Failures in this process occur when a bank seeking liquidity cannot convince a liquidity-provider that it is indeed solvent and will be able to repay the loan. These markets will also be ineffective if the potential supplier of liquidity can demand a high price because there are few, or indeed no, alternative sources of liquidity the distressed bank can turn to. In such cases, liquidity problems at healthy banks can turn into solvency problems, because banks are forced to sell their long-term assets below fair value, or are unable to borrow enough funds on the interbank lending market. Section 4 reviews the literature on the market provision of liquidity. In addition to being an initiating factor in individual bank failures, inefficiencies in markets for liquidity are also part of crisis propagation because they can promote the spread of failures.

The propagation aspect of financial crises implies that one dimension of financial crises is the spread of the liquidity or solvency problems faced by one bank or group of banks to other banks. This is known as contagion. The third group of models provides explanations for contagion between banks. They examine two channels through which financial distress can spread from bank to bank. The first channel—information spillovers—occurs when events at one institution provide some information about the viability of other banks in the economy. Information spillovers can arise when banks are subject to common economic influences, and problems at one bank are seen as revealing information about the viability of other banks. Contagion can also occur when banks lend to and borrow from each other; that is, when they have credit exposures to each other. These credit exposures arise from contractual arrangements to share risk among banks (one example is interbank deposits), and from banks' participation in payment, clearing, and settlement systems. Section 5 reviews the explanations of bank contagion.

By definition, financial crises are events that have significant adverse effects on the real economy. The final group of models explains how financial events can have major consequences for the economy. These approaches demonstrate how the financial sector amplifies shocks to an economy via a mechanism called the *financial accelerator*. These explanations demonstrate that the terms of the financial contracts between lenders and borrowers can adjust in response to a small change in the economic environment in a way that magnifies the effect of that change and leads to large fluctuations in economy activity. They are reviewed in Section 6.

2. Stylized Facts about Financial Crises

2.1 Financial crises result in substantial real costs in economic output

Financial crises lead to the misallocation and underutilization of resources, resulting in losses of real output. To provide a rough estimate of the costs of crises, studies typically compare GDP growth after a crisis with trend GDP growth. The cost in lost output is estimated by adding up the differences between trend growth and actual growth in the years following the crisis until the period in which annual output growth returned to trend. This methodology has some drawbacks. In particular, it tends to overstate the costs of financial events when they are correlated with downturns in the business cycle.

The International Monetary Fund (IMF 1998) studied 53 industrial and developing countries between 1980 and 1995 (a period which excludes the Asian crisis) and identified 158 currency crises and 54 banking crises. The study estimates that the cumulative output loss associated with the 158 currency crises averaged 4.3 per cent of trend GDP. Banking crises were more costly: cumulative output loss from the 54 banking crises averaged 11.6 per cent. When banking and currency crises occurred within a year of each other (such phenomena have recently been termed "twin crises" in the literature), the losses were substantially larger, amounting to 14.4 per cent, on average. Output losses were, on average, greater in emerging than in industrial economies.

2.2 Episodic or transitory?

Even for the countries that incur them most frequently, financial crises are transitory in duration and effect. For the sample of crises identified in the IMF (1998) study, recovery from currency crises took, on average, about 1.5 years; banking crises about 3 years; and recovery from twin crises took slightly more than 3 years.

2.3 Onset difficult to predict

There is no strict correspondence between the preconditions for and the occurrence of a financial crisis. Certain features in an economy may be associated with higher risk (for example, a high ratio of short-term debt to short-term assets and of short-term debt to total foreign debt), but they do not necessarily imply a crisis. The five countries that experienced currency crises during the Asian crisis had rapid growth in bank credit and money supply relative to their GDP, as well as high levels of outstanding bank credit and money supply, but the three economies in the region with the highest ratios of short-term debt to total external debt in mid-1997 (Singapore, Taiwan, and Hong Kong) were the countries least affected by the Asian crisis. Furthermore, there is evidence that the East Asian crisis was not anticipated by world markets (Marshall 1998).

2.4 Often preceded by a period of credit expansion

Kaminsky and Reinhart's (1999) study of 26 banking and 76 currency crises in 20 countries for the period 1970 to mid-1990 concludes that a common precursor to a crisis was an above-normal rate of growth in money and credit.

2.5 Involve liquidity shortages

In banking markets, a liquidity crunch can result from the liability side of the balance sheets of banks suffering a run on deposits, usually by wholesale depositors, or from the asset side owing to declines in banks' cash-asset ratios. A decrease in the loans-to-assets ratios of banks can also signal a credit crunch. Sharp increases in interest rates on deposits and loans that are not fully justified by changes in the riskiness of loans indicate that the decline in bank lending is a supply-side phenomenon. Banking crises were generally accompanied by declines in bank deposits and bank lending and by increases in the interest rates on loans and deposits (Gupta 2000). However, in a sample of 32 banking crises over the 1970–95 period, bank runs occurring without currency runs did not result in a significant change in the total deposit-to-GDP ratio. Therefore, there were runs on individual banks but not on the banking system as a whole. A banking crisis that was accompanied by a run on currency, however, saw significant decreases in the deposits-to-GDP ratio (Demirgüç-Kunt, Detragiache, and Gupta 2000).

2.6 Unstable asset prices

Collapses of stock and real estate markets typically accompany or precede banking crises. This was true of Japan in 1990, Scandinavia (Norway, Finland, and Sweden) in the 1980s, Mexico in 1994, and East Asia in 1997. According to Kaminsky and Reinhart (1999), a typical crisis was preceded by an average rise in the price of stocks of about 40 per cent per year above that occurring in normal times. The prices of real estate and other assets also increased significantly. At some point, the bubble burst, and the stock and real estate markets collapsed (not necessarily simultaneously). In many cases, banking and/or currency crises followed. Although it is usual in a crisis for both stock and real estate markets to collapse, there is no evidence that the collapse of both markets is a necessary condition for a financial crisis.

2.7 Contagion within and across markets

Contagion across financial institutions is a common feature of financial crises. In the Swedish (1990) and Norwegian (1985) banking crises, problems first emerged in finance companies and then spread to banks, because of the banks' involvement in the finance companies (Drees and Pazarbasioglu 1998). In Argentina (1995), depositor runs started at wholesale banks and spread to retail banks. Contagion in the banking sector was also evident in Venezuela (1994) and in Paraguay (1995) (García-Herrero 1997).

2.8 Loss of confidence by investors

A loss of confidence manifests itself as a flight to quality when investors or financial institutions cut back on the amount of liquidity they are willing to provide. Furthermore, this withdrawal of liquidity is not based on any objective deterioration in the quality of the borrower but is more a function of investor sentiment. Evidence of a loss of investor confidence can be seen in the dramatic reversal of capital flows associated with recent financial crises. For example, the capital inflow to the five economies involved in the Asian crisis went from $93 billion in 1996 to $12.1 billion in 1997. This reversal represented 11 per cent of the combined GDP of those five countries.

3. Coordination Failure

The demand-deposit contracts that banks offer depositors give rise to payoff externalities among depositors. Payoff externalities occur when the actions of one individual affect the payoffs to other agents and thus may alter the behaviour of other agents.[3] The payoff externalities inherent in demand-deposit contracts can lead to bank runs, which occur when the amount a bank has to pay out exceeds the value of its liquid assets. Such bank runs are the result of coordination failure among depositors and are based on self-fulfilling expectations. Although depositors are collectively better off if they all do not run on the bank, each depositor is individually better off doing so, given their expectations of a bank run. Because banks' deposit contracts promise payment on demand, while their funds are invested in long-term assets, there is a maturity mismatch in their portfolios. Thus, if more depositors than expected withdraw funds in the short term, banks do not have sufficient short-term assets to pay off all the depositors who wish to withdraw and must liquidate their long-term assets at a loss. This assumes that liquidating the long-term assets involves interrupting production processes, which leads to economic losses. The liquidation of long-term assets reduces the funds available to depositors who withdraw later, thus raising the incentive to withdraw early. Therein lies the payoff externality. This implies that the last depositors to leave a failing bank suffer the greatest losses (they are the least likely to recover their investments). The same can be said for lenders who invest in other countries when payoff externalities exist, again leading to the possibility of international financial and currency crises. Thus, crises can happen quickly and dramatically as everyone rushes for the exit.

Some economists have suggested that the Asian financial crisis of 1997 is a prime example of coordination failure among international investors, primarily the international banks from industrial countries that invested their excess liquidity in the emerging economies of East Asia through local banks. These investments were mainly in the form of interbank (or wholesale) deposits. Evidence of coordination failure rests on the lack of a clear triggering event commensurate with the scale of the crisis that ensued. Furthermore, there was evidence that neither investors nor knowledgeable observers expected the crisis.

The economic literature cites two main reasons why banks use demand-deposit contracts (despite their potential for causing bank runs). First, they allow consumers to hedge against unexpected consumption needs before long-term investments yield returns. By promising depositors a fixed amount at any time they wish to withdraw, banks allow depositors to consume when they need to, instead of only after long-term investments have paid off. Second, banks use demand-deposit contracts as a precommitment device that enables the bank to raise funds, since these contracts are enforceable by law and commit banks to paying out a specified amount to depositors who wish to withdraw.

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3. This also implies that the payoff to the individual depends on the actions of other agents.

3.1 "Sunspot" equilibrium models

One explanation attributes coordination failures to "sunspots," phenomena that have no apparent causal link to banking crises.[4] This approach builds on the fact that consumers differ in terms of the timing of their consumption needs and are uncertain about this timing in advance. Some may turn out to be "impatient" and need to consume before long-term investments pay off. Others may be "patient" and can wait until those investments have paid off before consuming.[5] However, consumers do not know what type they are when investments are made. Thus, if consumers undertook their own investments, they can expect a high level of consumption (call this level of consumption c_P) if they are patient, but a low level of consumption (call this level c_I) if they are impatient and need to consume right away by liquidating their investments at a loss. The best that consumers can do on their own is to invest all their resources in productive long-term assets and then, if they turn out to be impatient, liquidate those assets at a loss. Since consumers are risk-averse, they would prefer to trade off a small amount of consumption in advance if they could achieve a higher consumption level later. Hence, they prefer the consumption bundle (c_I^*, c_P^*) where $c_I^* > c_I$ and $c_P^* < c_P$, where the subscript I denotes impatient consumers and the subscript P denotes patient consumers.

A bank is able to offer consumers the preferred consumption bundle by pooling and investing their resources and writing a demand-deposit contract that allows impatient depositors to withdraw the amount c_I^* early and patient depositors to withdraw the amount c_P^* later. This is because the proportion of impatient consumers in the population is fixed. By investing just enough resources in short-term (liquid) assets, which can be used to fund the withdrawals of all the impatient consumers in the economy and the rest in more productive long-term (illiquid) assets, banks achieve an efficient mix of long-term and short-term investments that does not entail incurring losses through the liquidation of long-term assets.

There are two possible outcomes to the game depositors play in the standard model of coordination failure: the "good" outcome, in which no run occurs because all the patient depositors expect others to wait until long-term assets have paid off; and the "bad" outcome, in which a bank run occurs because each patient depositor expects all other patient depositors to withdraw early.[6] In the good outcome, all consumers achieve their preferred consumption profile. In the bad outcome, however, all productive assets have to be liquidated, and consumers end up with less than they would have had, had they not deposited their wealth at the bank. Banking instability is reflected in the "bad" outcome, in which the bank run interrupts production and creates losses for the economy. There is no a priori reason that one outcome should be chosen over the other. In other words, there is an indeterminacy in the outcome of this model. Because the outcome that prevails is sensitive to the expectations of depositors, anything (including sunspots) that leads to a shift in expectations about what proportion of depositors will withdraw early can trigger a crisis. Therefore, bank runs are unpredictable and are often not justified by economic reality. Hence, these models can also be referred to as *random-crises models*.

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[4] In this context, sunspots refer to events that cannot be explained and are thus considered to be completely random.

[5] Although most of the literature casts consumer differences in terms of "types" (patient or impatient), these differences can also be thought of as "events" (idiosyncratic shocks to the consumer that initiate a desire to make withdrawals).

[6] The standard coordination failure model of bank runs is first outlined in Diamond and Dybvig (1983).

These explanations do not shed any light on the process by which depositors' expectations are formed, however. All the other models examined in this paper build on the standard model just described, one in which consumers differ in the timing of their consumption, and banks offer deposit contracts to enable consumers to obtain their preferred consumption bundle. But other models may or may not assume that coordination failure is a feature of the economy. That is, some models will rule out self-fulfilling bank runs and assume that depositors run on banks only when they know that the banks are insolvent and will not be able to meet their obligations, even after their long-term assets have paid off.

3.2 Equilibrium-selection models

The indeterminacy in outcome, or equilibrium, associated with the standard coordination-failure model can be eliminated by introducing some uncertainty about the health of banks and differential, or asymmetric, information among depositors. There is thus some uncertainty about how profitable a bank's long-term investments will be. Differential information among depositors can arise from differences in the way they interpret information about the health of banks or differences in their ability to discern the health of banks. This approach builds upon the standard model of coordination failure and examines more closely the process by which expectations are formed and, consequently, the equilibrium that is "selected."[7]

In one model, put forward by Morris and Shin (2000), depositors base their withdrawal decisions on the information they receive about banks' profitability. Thus, changes in depositors' expectations are related to information that they receive after depositing their funds in the bank and before the bank's long-term investments pay off. Although no depositor knows the profitability of the bank perfectly, they each have some idea about it. Consequently, depositors who think that their bank's long-term investments are profitable enough will keep their deposits in the bank and wait until those long-term assets have paid off before withdrawing. But depositors who think that their bank's long-term investments are not profitable enough will withdraw immediately.[8] Note, however, that this decision is based on whether the bank is able to meet its withdrawals in the long term, and this depends on expectations about how many depositors will choose to withdraw early. Depositors who think that the bank is unhealthy also believe that other depositors may perceive the same situation and decide to withdraw early. If enough depositors think the bank is not very healthy, a bank run occurs. Hence, the information that depositors receive helps them to select their action and determines the outcome (whether there will be a bank run or not). Since bad news is more likely when the bank is, in reality, unprofitable, the probability that a bank will be run on depends on its real state of profitability.

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[7] This approach is taken by Morris and Shin (1998, 2000), Goldstein and Pauzner (2000), Chari and Jagannathan (1988), and others in the economic literature on "herding" behaviour.

Another model, advanced by Chari and Jagannathan (1988), introduces differences in information among depositors by assuming that there is a group of depositors who are perfectly informed, and that the rest are uninformed; i.e., some depositors know more than others. Furthermore, there is also uncertainty about the proportion of impatient consumers in the population. Those depositors who have perfect information will withdraw funds upon learning that their banks are unprofitable, regardless of whether they are patient or impatient. The other patient depositors will try to infer the bank's health by the number of withdrawals observed. They can only guess, however, at what the informed depositors know, since a long line of depositors waiting to withdraw may indicate that informed depositors know that the bank is unhealthy or may simply mean that there is a high number of impatient depositors. In this model, a bank run can occur even when the bank is healthy because there is a significant proportion of impatient depositors in the economy. This type of bank run is called a "panic" because it would not have happened if everyone knew about the actual health of the bank.

These models show that new information can trigger a financial crisis. Bank runs, however, are still based on self-fulfilling expectations, as in the standard model. Each depositor has some idea of how healthy, or profitable, the banks are, but it is their expectations regarding how many other depositors will withdraw early that will determine their actions. Those expectations are, in turn, conditioned by what ideas the depositors have about the banks' health. The probability of a run occurring in these models is higher if banks really are weak and lower if banks are healthy. Hence, this approach views crises as being *fundamentals-based*, since the probability of a bank run occurring is related to the true health, or fundamentals, of banks.

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[8] Whether a bank is or is not profitable enough for a depositor also depends on what they believe other depositors might do. This stems from payoff externalities, described in the discussion on coordination-failure models.

3.3 Limited-commitment models

Economic agents are often unable to commit to an action to be undertaken in the future, either because the action cannot be observed or because it cannot be enforced by law or by consideration to reputation. This limited commitment on the part of agents can determine the nature of contracts between banks and depositors.[9] In such an environment, in the absence of demand-deposit contracts, banks cannot commit to paying out the full amount promised to depositors. A bank will always try to renegotiate the terms of the contract to its advantage, at the expense of depositors, after investments have been undertaken. Consumers, anticipating this, will refuse to deposit their funds at such a bank. Demand-deposit contracts, however, make it unprofitable for the bank to attempt to renegotiate contracts. Under the terms of the demand-deposit contract, a bank is obligated to pay out in full the contracted amount to withdrawing depositors who are first in line until the bank runs out of assets. This feature of the demand-deposit contract is called the *sequential service constraint*. Such a feature makes it individually rational for each depositor to be the first to withdraw funds when a bank tries to renegotiate the terms of the deposit contract, although collectively depositors would find it in their interest to renegotiate with the bank for a smaller payment, since the bank has fewer assets available if it must liquidate its long-term investments. Hence, banks use demand-deposit contracts as a precommitment device to enable them to attract funds from depositors. The potential for coordination failure among depositors prevents banks from renegotiating the deposit contract, and thus helps banks to commit to paying out the promised amount to depositors. However, demand-deposit contracts also carry the risk of a bank run if the bank encounters a situation where it needs to renegotiate the deposit contract. Let us consider one such situation.

Suppose there is an unanticipated shock to the economy that changes the timing of the payout from banks' investments such that banks are unable to pay out the promised amount in the short term, although they can compensate for this with a higher payout in the long term. This necessitates a renegotiation of the contract between the banks and their depositors. Although depositors may be not worse off, or indeed may be better off, by accepting a new contract that promises a higher long-term payout in exchange for a lower short-term payout, coordination failure among depositors would cause individual depositors to stage a run on the bank instead of accepting the new contract. The bank would then fail because it would be unable to renegotiate with its depositors. Such a bank run would result in losses for the economy, stemming from the interruption of otherwise profitable projects, and a negative outcome for all depositors.

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[9] This argument is developed in Diamond and Rajan (2000, 2001a, b).

3.4 Discussion and policy implications: Coordination failure

Models of bank runs resulting from coordination failure describe the effects of a loss of confidence by depositors resulting from changes in their expectations. Banks that are solvent in the long run can be pushed into failure when too many consumers withdraw their deposits in the short run, because the excess withdrawals create liquidity problems for banks. In the standard model, described by Diamond and Dybvig (1983), these changes in expectations are unexplainable, and the factors causing the changes have been labelled "sunspots." Other approaches try to explain the changes in expectations, and point to changes in information or new information, as the trigger for changes in expectations that may lead to bank runs. These explanations represent the real side of the economy as projects, or investments, that banks undertake on behalf of their depositors. Contracts between banks and depositors are also restricted to short-term, demand-deposit contracts. But demand-deposit contracts are not necessarily the only contracts available that can help consumers manage their uncertain timing of consumption. Given that demand-deposit contracts involve the potential cost of bank runs, they may not be the most desirable contracts from society's point of view. With the exception of the limited-commitment approach, the literature on coordination-failure-based bank runs has not provided a rationale for the use of demand-deposit contracts, but it notes that those contracts are observed in reality and are optimal in the context of other models.

Financial crises can result from a coordination failure when an inferior outcome (one involving a bank run) is chosen. Central authorities should intervene if they can eliminate the coordination failure when private arrangements cannot. Some authors suggest that deposit insurance can help to coordinate patient consumers' actions to obtain an outcome where only impatient consumers withdraw early and no bank run occurs. Allowing banks to suspend convertibility of deposits (to cash) when a threshold level of early withdrawals is reached can also eliminate coordination failure, since this ensures that there is always a minimum amount of resources to be shared among the patient depositors who withdraw in the next period. Under a suspension, a patient depositor can be guaranteed to obtain more by waiting than by withdrawing early. The incentive for patient consumers to withdraw early is thus removed, and coordination failure is eliminated. Deposit insurance achieves the same end by ensuring that patient depositors will always receive the promised amount if they wait to withdraw.

An important part of ongoing efforts to improve the international financial structure in the wake of the Asian crisis involves greater transparency of information in the financial sector. Equilibrium-selection models, such as those provided by Morris and Shin (2000) and Goldstein and Pauzner (2000), provide a framework for discussing changes in the structure of information. The information structure can be changed in two distinct ways. The first involves ensuring that all depositors have precise knowledge about the state of the banks' health, which eliminates all uncertainty. This brings us back to the world of the standard model, where coordination failures and financial crises can arise for no apparent reason. The second aspect of improving transparency involves increasing the precision of information received by each depositor, although this information can be different from depositor to depositor, and no one can know precisely the actual state of banks. That is, it involves reducing depositor uncertainty about banks' health but not completely eliminating it. This approach decreases the probability of bank runs.

Taxing early withdrawals is another way to reduce the likelihood of self-fulfilling bank runs. An early-withdrawal penalty effectively reduces the payoff to those who withdraw funds early. This measure is costly, however, because it penalizes those who need to consume early. Self-fulfilling bank runs that are not justified by economic reality create a role for a lender-of-last-resort to bail out illiquid banks. Intervention can always improve the welfare of society if authorities have better information about banks' solvency than depositors. But when the authorities are no better than the public at distinguishing a sound bank facing liquidity problems from one that is unsound, then lender-of-last-resort activities can be justified only if the expected benefit of preventing the failure of sound but illiquid banks outweighs the expected cost of bailing out banks that are unsound and illiquid.

In limited-commitment models, the coordination-failure feature of bank deposit contracts arises endogenously and, thus, has a useful role. While that feature of bank deposit contracts can cause problems for the banking system under some, perhaps rare, circumstances, they exist to overcome the problem of limited commitment on the banks' part. In this framework, the elimination of coordination failure is costly to the economy in terms of inhibiting the ability of banks to raise funds in the first place.[10] To create liquidity and enhance the flow of credit in the economy, banks choose a desired ratio of bank equity to deposits that entails some fragility. In normal circumstances, this fragility does not result in a financial crisis. But things can unravel quickly in the face of a shock, and the fragility of the banking system can lead to a financial crisis. Higher capital requirements, deposit insurance, and bank contracts with suspension of convertibility are examples of measures designed to prevent crises. Providing banks with subsidized loans or capital and a suspension of convertibility after a shock can help stabilize the situation and contain crises. However, measures designed to prevent or contain crises remove the features of demand-deposit contracts that create commitment on the part of banks and limit the ability of banks to raise funds in the first place. From this viewpoint, it is not necessarily welfare-improving to avoid financial crises altogether. It may be preferable to allow crises to happen and then manage them to minimize their costs. This is in direct contrast to the "sunspots" equilibrium and equilibrium-selection models of coordination failure. In those models, the coordination-failure aspect of demand-deposit contracts is an undesirable by-product, and everyone is better off if the authorities eliminate the possibility of coordination failure.

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[10] Higher capital requirements, deposit insurance, and bank contracts with suspension of convertibility are examples of measures designed to prevent crises

4. Failure of Markets for Liquidity

If markets for liquidity work effectively, then a solvent bank that faces short-term liquidity problems (for example, excessive withdrawals) will be able to obtain liquidity by borrowing funds from other institutions or by selling its assets to tide it over during its liquidity problems. Markets for liquidity may be inefficient, however, because of market power or informational asymmetries, and, hence, even healthy banks can see liquidity problems turn into solvency problems if they are required to sell their assets at fire-sale prices or if other institutions refuse to lend.

4.1 Market power in liquidity markets

When banks seek to obtain cash by selling off their long-term assets, the cost of obtaining liquidity is often high. A model developed by Donaldson (1992) makes the point that when agents who provide liquidity possess market power (a situation where there are few or no alternative sources of liquidity, so that the liquidity-provider can command a high price), liquidity is costly and inefficiently provided. Consider the case where a bank that requires cash beyond its holdings of liquid reserves can issue securities, or claims, on its long-term assets. Agents that provide liquidity by holding large reserves of liquid assets (say, cash) are called reserve agents. The prices of securities issued by banks are determined by competition among reserve agents. When the banks' need for liquidity is low, or if no reserve agent has market power, securities trade at a "fair" price, which is equal to the expected gains from holding that asset. However, if the banks' demand for liquidity is high, or if the distribution of cash among reserve agents is such that some agents hold the bulk of the liquidity available in the market, then securities trade at an average price below that of their fair value.

To illustrate this situation, suppose banks invest *all* of their deposits in long-term assets that yield a bank-specific return, R_j, for bank j, and this is public information. Bank j has deposits in the amount A_j on which a return of R^D per dollar deposited is promised. That is, bank j will pay R^D for each dollar of deposits withdrawn at any period. The dollar amount of securities that bank j can issue is A_jR_j, since it has A_j invested in long-term assets that will yield R_j. Let p be the average price of a bank security with a face value of one dollar. When the market for bank securities is competitive, p is equal to one. However, when a reserve agent holds much of the available liquidity in the market, or when banks are trying to sell a large amount of securities, the securities may trade at a price less than one. When this occurs, reserve agents are said to possess market power.

Consider a shock to some banks that causes their rate of return on long-term assets to fall below the rate of return promised to depositors: $R_j < R^D$. That is, some banks become fundamentally insolvent. Depositors will start a run on those banks to try and recover the full value of their deposit.[11] Those banks will issue securities to meet their cash needs. This can lead to a high enough demand for liquidity that the market power of reserve agents increases, and the average price of securities, p, falls. This makes liquidity more costly for all banks. If the average security price falls enough, some banks that are fundamentally solvent (the return on their long-term assets is higher than the return promised to depositors: $R_j > R^D$) can become "liquidation insolvent" (the value of their securities is lower than the return promised to depositors: $pR_j < R^D$). When this happens, the liquidation-insolvent banks can be the target of a run. Hence, contagion can arise. In this example, the amount of liquidity in the market is taken to be fixed, but this liquidity can be costly precisely when the need for it is high, and a shock that causes a few banks to become insolvent can make liquidity so costly that it creates liquidity problems even for solvent banks.

Although Long-Term Capital Management cannot be modelled as a bank in this example, the concern that the failure of one institution can reduce market liquidity to the extent that other financial institutions can be hurt prompted the bailout of LTCM in 1998. This was conducted under the auspices of the Federal Reserve Bank of New York and involved the cutting of the target for the federal funds rate before the regularly scheduled meeting of the Federal Reserve Board.

In a different model, Allen and Gale (1998) examine how the amount of liquidity available in asset markets is determined (and, hence, the degree of market power possessed by cash-providing investors) and show that a competitive market for bank assets cannot be a reasonable outcome. This is because investors have to give up better investment opportunities in order to hold liquid reserves and therefore need to be compensated for holding those reserves. This compensation takes the form of the prospect of a capital gain from purchasing an illiquid bank's long-term assets at a discount. Thus, the market is willing to supply liquidity to distressed banks only if the terms are sufficiently profitable for the liquidity provider.[12]

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[11] Notice that these depositors do not run on the bank because of self-fulfilling expectations but only upon learning that their bank is insolvent.

4.2 Imperfect information in interbank markets

Banks can also contract with other banks for liquidity in times of need. Banks hold reserves (this can be in the form of cash, treasury bills, or demand deposits on other banks) to meet their own needs for cash arising from random withdrawals by depositors.[13] Some banks find themselves with excess liquidity after withdrawals take place, while others may be short of liquidity. In this case, it may be cheaper to obtain liquidity by borrowing from other banks than from non-bank sources. A model by Bhattacharya and Gale (1987), however, shows that when banks cannot observe the level of reserves held by other banks, this lack of transparency can limit the effectiveness of lending arrangements between them. This is because banks will try to "free-ride" by relying on each other for liquidity and will underinvest in their own liquid balances. When this underinvestment occurs, banks offer deposit contracts that are inferior to those that would be offered had the banks invested in the correct level of liquid reserves, and the return on interbank loans is lower than the return from long-term investments. Since all banks hold too little in liquid assets, aggregate liquidity in the banking system is lower than society would prefer it to be.[14] This means that banks promise a smaller amount to depositors who desire to withdraw early, and consumers are thus penalized for being impatient.

Even if each bank's investment in reserves can be perfectly observed, uncertainty about the solvency of banks subjects a lending bank to credit risk (the risk of having the borrower default on the loan), because the lending bank cannot distinguish between a solvent bank and an insolvent bank. This phenomenon is demonstrated in a model by Alger (2000). Lack of information about borrowing banks may prevent a liquid bank from lending to an otherwise solvent but illiquid bank because the risk of not being repaid is too high. Hence, if credit risks are too high, the interbank market can collapse. In addition, the amount of credit risk in the economy may be related to the state of the business cycle. Specifically, credit risks, and hence the likelihood of an interbank-market collapse, increase with an economic downturn. The collapse of the Canadian Commercial Bank (CCB) and the Northland Bank increased the perception of credit risk in the banking sector, particularly among banks based in western Canada, which made it difficult for other small financial institutions to obtain interbank funding. (See essay by Fred Daniel.)

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[12] There is also a lending version of this story. Other agents may lend to an illiquid bank at interest rates that are too high (relative to a competitive lending market) because they need to be compensated for foregoing investment opportunities by holding reserves. Liquidity is expensive for the troubled bank to acquire, whether it seeks to sell its assets or to borrow funds, since these activities must involve a capital gain or non-competitive interest rate for the provider of liquidity.

[13] This assumes that banks are uncertain about the proportion of their depositors who are impatient and will withdraw early.

[14] The interbank market can also be inefficient because banks invest too much in liquid reserves. Using a different framework, Bhattacharya and Fulghieri (1994) show that banks can overinvest in liquid assets, and when this happens, the return on interbank loans is higher than the return from long-term investments. The overinvestment in liquid reserves leads to fewer resources being invested in productive assets and, thus, to lower economic activity.

4.3 Discussion and policy implications: Failure of liquidity markets

Models that focus on the potential for failure in liquidity markets reinforce the idea that otherwise-solvent banks can fail as a result of liquidity problems. They demonstrate that these markets can be ineffective when there are market imperfections, such as market power and imperfect information, and that this ineffectiveness may prevent a solvent but illiquid bank from obtaining the liquidity necessary to avoid insolvency.

Asset markets can fail to provide banks with sufficient liquidity when the value at which the asset trades is lower than the asset's fair value. Intervention by the central bank, however, can prevent this. By injecting liquidity into the economy, the central bank supports the long-term asset's price at its fair value. This can be done through a repurchase agreement, whereby the bank sells its securities to the central bank for cash when a run occurs and buys them back for the same price in the next period, when they realize their returns from long-term assets. By providing liquidity in this way, the central bank ensures that the bank does not suffer a loss by having to sell its holdings of long-term assets at fire-sale (discounted) prices.

In a situation where the interbank market fails to work properly because of a lack of transparency about banks' reserve levels, the authorities can help if they are able to enforce the "correct" level of reserves held by banks. With credit risks in the interbank market, however, enforcing the correct level of reserves will not help, since banks with excess liquidity may refuse to lend when credit risks are too high. In this case, the authorities may help by improving the flow of information in the market. Failing that, the authorities may step in to lend to solvent banks that are unable to borrow from other banks. This assumes, however, that the authorities have better information than the market. When the authorities have less-than-perfect information and cannot distinguish solvent from insolvent banks, such a policy could be costly if it allowed insolvent banks to survive for too long.

5. Contagion

Contagion refers to the spread of failures from bank to bank in a system. Contagion thus has to be modelled in the context of multiple, heterogeneous banks. In models of contagion, banks typically differ in two ways. First, banks can differ in the profitability of their long-term assets, because they hold different portfolios of assets that yield different returns. Second, banks can differ in the timing of withdrawals, because they find themselves with a different proportion of their depositors wanting to withdraw before the bank's long-term assets pay off. Although banks are not subject to self-fulfilling runs by depositors, contagion can occur when the returns to the banks' assets are all affected by the same influences. That is, the returns are correlated: a high return at one bank implies a good prospect of high returns at other banks and vice versa. In this case, events at one bank, or at a subset of banks, may provide information about the profitability of other banks. Depositors will thus condition their withdrawal decisions on what occurs at other banks. Another way that failures can spread contagiously among banks is through the credit exposures that banks have to each other through interbank lending and borrowing (credit linkages). These credit exposures cause the performance of banks to be correlated even when the returns to individual bank assets are independent.

5.1 Information contagion

Inferences drawn from events occurring at some banks in the economy can be a source of contagion (Chen 1999; Aghion, Bolton, and Dewatripont 2000). The failure of a bank, or a subset of banks, can provide information about the solvency of other banks and can cause a run by depositors at other banks, once they have revised their expectations about the returns from their deposits at those banks. The spread of liquidity problems that started at the CCB and the Northland Bank to other small regional banks in 1985 was an example of information contagion, which eventually forced the smaller banks to merge with larger, better-capitalized banks. This contagion occurred when wholesale funding was pulled out of other regional banks that looked similar to the CCB and the Northland.

To see how information contagion can occur, suppose that a proportion of depositors learn what their banks' risky project returns will be (there are depositors who are knowledgeable and can interpret information about their banks correctly, while others cannot), and that the information about one group of banks in the economy arrives first, while information about the second group of banks arrives later. As in the standard model laid out in the section on coordination failures, impatient consumers will withdraw their funds early, whether they are knowledgeable or not. The patient consumers who are knowledgeable will also withdraw their funds if they learn that the returns to their banks' long-term assets are low (their bank is insolvent in this case). Hence, there is a run on the insolvent banks in the first group, while the solvent banks survive. This does not pose a problem for the economy. However, the depositors at the banks in the second group may respond when they observe the number of failures in the first group. These depositors may stage a run on their banks even before they receive information about the outcome of their own banks' projects. In this situation, even banks whose projects may be profitable will be subject to runs. The irony is that, even though some depositors expect to learn about the solvency of the banks in the second group, they do not wait to receive the information. This occurs because depositors who are not knowledgeable will respond to the information provided by the failures of other banks, since they have no other information to go by. Knowledgeable depositors, aware that other depositors may initiate a run, will also withdraw before they receive information about their banks' asset returns. Hence, runs at individual banks can be contagious and provoke a banking panic on the rest of the banks.

5.2 Contagion via credit linkages

When banks lend to and borrow from each other, either through interbank loans or interbank deposits, these credit linkages can give rise to contagion (Allen and Gale 2000; Dasgupta 2000). Banks might desire to hold interbank deposits with each other because they differ in the timing of withdrawals by their depositors. That is, banks are initially uncertain of the proportion of impatient depositors that they have. When impatient depositors seek withdrawals, a bank faces a liquidity shock. Because the liquidity shock faced by an individual bank is unrelated to the liquidity shocks that other banks receive, there is an incentive for banks to pool their risk by holding interbank deposits. Thus, when a bank finds itself with a high level of early withdrawals and the amount it has to pay out to impatient depositors exceeds the amount of reserves it holds, it can draw on its deposit with another bank that is facing a lower level of early withdrawals. This way, banks can economize on the amount of reserves that they need to hold individually and rely on the interbank market to allocate liquidity to those banks that need it. In the absence of these credit links, performance (investment returns) is independent across banks, and so no contagion can take place. Credit linkages cause bank performance to be correlated, however, and can allow the contagious spread of liquidity problems or failure.

In a model by Allen and Gale (2000) four banks are used to demonstrate this. Four banks in different locations (regions A, B, C, and D) face liquidity shocks that are regional. However, the shock to one region is assumed to be always offset by a shock to another region. That is, for a region with a high liquidity shock, there is another region with a low liquidity shock. To pool their risk, banks hold deposits in banks in other regions. These interbank deposits are subject to the same terms as those of other depositors. Various configurations of deposit patterns among banks can be considered. (i) In a "complete" interbank market, banks hold a small level of deposits in the banks in all other regions. For example, a bank in region A will hold deposits in banks in regions B, C, and D. (ii) In an "incomplete" interbank market, banks hold (larger) deposits in banks in the neighbouring region only. That is, a bank in region A holds deposits in the banks in region B, a bank in region B holds deposits in the banks in region C, a bank in region C holds deposits in the banks in region D, and a bank in region D holds deposits in the banks in region A. (iii) In a "disconnected" interbank market, banks in regions A and B hold deposits in each other, while banks in regions C and D hold deposits in each other.

An economy in which the shock to one region is always offset by a shock to another region is an economy with no aggregate risk. If all banks hold the same amount of reserves, equal to the average size of total early withdrawals at each bank, there will be no shortage (or surplus) of liquidity in the economy as a whole, even though individual banks can be short of reserves or have excess reserves. Each of the three interbank market structures works equally well in this situation. However, suppose there is an unanticipated situation in which the bank in one region, say region A, has a larger liquidity shock than could be anticipated, so that the banking system as a whole is short of liquidity. This shock could be so large that region A's bank becomes insolvent and fails. This implies that it cannot pay out its deposits in full. Since other banks are holding deposits at this bank, these banks see a decline in the value of their assets, since their asset base includes deposits in region A's bank. If this decline in the value of the assets of a counterparty bank is large enough, that bank could become insolvent as well. Thus, the failure has spread from region A to another region.

The risk of contagion increases with the size of the credit linkages. Hence, contagion is more likely to occur in an incomplete or a disconnected market structure than in a complete market structure, since the size of interbank deposits is larger in the incomplete or disconnected market structure. Thus, the structure of the interbank market is an important determinant of the likelihood of bank contagion. How these various structures may come about is still unexplored in the literature on bank contagion.

5.3 Discussion and policy implications: Contagion

The literature on bank contagion demonstrates that insolvency can spread not only among banks with credit exposures to each other, but also among those without credit exposures to each other, leading to widespread liquidity problems in the banking system and causing otherwise solvent banks to fail. The onset of a crisis is often unpredictable, but the spread of liquidity problems from the originally troubled bank to other banks may be predictable. Contagion tends to occur among banks that are similar to each other, so that their performances are perceived to be subject to the same influences, or among banks with large credit exposures to each other. The risk of contagion, however, depends very much on the type of linkages (interbank loans or deposits), the pattern of linkages (interbank market structure), and the size of the exposures among banks. These factors are taken as given in the models and left unexplained in the literature. More work needs to be done to rationalize these features of the interbank market before we have a consistent explanation of contagion.

Although restrictions on the size of credit linkages may reduce the risk of contagion in the banking system, such restrictions could impede the freedom of banks to pursue their desired investment strategies. When contagion risk is high in the aftermath of a shock to one bank or to a subset of banks, bailing out an insolvent bank may be justified by the need to prevent the insolvency from spreading to other banks. There are, however, costs to bailing out a failing bank that are not considered in the models, and these costs must be weighed against the benefit of preventing contagion. One of the main concerns about implicit and explicit bailout guarantees by the authorities is that they can cause banks to take too much risk. This is referred to as "moral hazard" and is discussed in greater detail in the essay by Fred Daniel.

Contagion risk is often seen in the literature as an undesirable by-product of rational and otherwise desirable, actions that banks take (for example, risk-sharing). In this case, eliminating contagion risk will improve social welfare if doing so is not too costly. In contrast, an alternative approach that emphasizes peer monitoring in the banking system, put forward by Rochet and Tirole (1996), points out that contagion risk is not necessarily bad when it promotes market discipline within the banking sector. The risk of contagion stemming from interbank credit exposures can create incentives for banks to monitor each other, which can reduce the risk of insolvency in the first place by reducing the scope for private, profitable bank mismanagement. This approach argues that insulating banks from each other's problems and eliminating contagion risks removes the incentives for banks to monitor each other. To provide incentives for monitoring, the lending bank's survival should be tied to the borrowing banks' performance. Hence, it may be desirable to close a solvent bank with exposure to illiquid banks when its borrowing banks become insolvent through mismanagement. In such a world, the optimal public policy needs to weigh the benefit of preventing a financial crisis generated by contagion against the benefits of market discipline induced by contagion risk.

6. Financial Accelerator

The definition of a financial crisis makes it clear that an event is considered a crisis only if it has adverse consequences for the real economy. We thus need to explain how financial events (or, more precisely, disruptions) can impinge on the workings of the real economy and thus on economic well-being. The notion that events taking place in the financial system directly affect the real economy is captured by financial-accelerator models. These models demonstrate that the terms of the financial contracts between lenders and borrowers, in situations where lenders have to incur a cost to screen borrowers to determine how risky they are or to monitor borrowers to ensure that they do not mismanage the funds they receive or attempt to renege on their loans, will adjust to small changes in the economic environment in a way that magnifies the consequences of those small changes, leading to large fluctuations in economy activity. In this approach, the financial system is viewed as an important source of fluctuations in the real business cycle.

The idea that the financial system can be a source of fluctuations in the real economy is not new. The collapse of the financial system, along with real output, during the Great Depression led Irving Fisher to theorize that high debt levels incurred during the period of prosperity preceding 1929 made the economy vulnerable to adverse economic shocks (which include shocks to the confidence of consumers and lenders). Although the direct effect of a business downturn was to precipitate bankruptcies by reducing companies' profits and raising fears of insolvency (which, in turn, fed the downturn) the more important effect was indirect. The deflation accompanying the economic slowdown redistributed wealth from debtors to creditors, since deflation increases the real value of outstanding debt. Debtors unable to repay debts or refinance positions were forced to liquidate assets. Distressed selling of assets led to falling asset prices. Creditors, seeing the nominal value of collateral declining with falling asset prices, called in loans, which in turn forced more liquidations. This decline in the net worth of borrowers induced them to cut back on current expenditures and future commitments, sending the economy spiralling down. This is Fisher's (1933) debt-deflation theory of the Great Depression.[15] A more recent example of this mechanism is provided by the recent downturn in the profitability of the telecommunications industry and the resulting reduction in spending on equipment and forced liquidations of some firms, which further reduced the profits of both telecom firms and their suppliers.

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[15] Interest in the linkages between the financial structure and the real economy was revived by empirical work (particularly that of Bernanke 1983) that lent credence to the view that financial factors were important in explaining the severity of the Great Depression.

Financial-accelerator models of economic downturns put more structure around Irving Fisher's story, which deals with situations where firms borrow to make capital investments, because their internal funds fall short of their desired investment levels at the given cost of funds. Furthermore, credit markets are characterized by imperfections (for example, lenders may not be able to distinguish a good credit risk from a bad credit risk perfectly, nor can they ensure that borrowers will not abscond with the borrowed funds). Lenders deal with these imperfections by charging a premium on their loans relative to internal funds (this is called the external-funds premium) or by requiring that borrowers secure their loans with collateral. This increases the cost of borrowed funds to firms and results in lower investment levels than would prevail in a world where the external-funds premium was zero. A lower investment level adversely affects a firm's net worth by lowering future cash flows. This reduction in net worth, in turn, increases the cost of funds because firms cannot supply sufficient internal funds towards their investment or post sufficient assets as collateral, and so firms invest even less in the next period. Hence, there is a feedback between firms' net worth and the cost of borrowed funds through the effects of investment on future net worth, which results in a "financial accelerator" that amplifies and propagates economic shocks through time. This effect can initiate or worsen a real business cycle.

There are two variants of the financial-accelerator story, one based on information problems between lenders and borrowers (Bernanke and Gertler 1989); the other based on contractual problems caused by limited commitment or by the inability of agents to precommit to repaying their loans (Kiyotaki and Moore 1997).

6.1 Financial accelerator caused by information problems

When lenders are unable to distinguish between good borrowers (those likely to repay their loans) and bad borrowers, or they are unable to observe the actions of borrowers after funds are loaned to them, borrowing involves a premium relative to the cost of using internal funds (for example, the entrepreneur's personal wealth or retained earnings). If lenders cannot costlessly observe or verify the actions of borrowers, they must incur costs to monitor borrowers in order to ensure that borrowers do not engage in actions that are detrimental to their ability to repay their loans. If lenders cannot costlessly distinguish between good and bad credit risks, they must incur costs to screen loan applicants in order to lend to good borrowers. These extra costs of lending incurred by lenders who have to screen or monitor borrowers (referred to as agency costs) are passed on to borrowers in the form of an external-funds premium. These agency costs are reduced if borrowers invests their personal wealth along with borrowed funds, since this aligns their incentives with lenders' interests. Hence, borrowers with larger net worth (cash flow, personal wealth) face lower external-funds premiums, in addition to needing to borrow less.

The cost of borrowed funds for a firm and, hence, its investment incentives, are inversely related to its net worth. A firm's investment level, by affecting future cash flow and, hence, net worth, also affects the external-funds premium it faces in the next period. This process has a tendency to feed on itself so that a small shock to net worth can result in large changes to output. Hence, the feedback between the firm's net worth and the external-funds premium creates a financial accelerator. A negative shock to the net worth of the borrowing firms in the economy increases the cost of borrowing for cash-constrained firms and reduces the investment levels of these firms. The reduction in investment causes the borrowers' net worth to decline further, and so forth, in a vicious cycle of declining net worth and increasing external-funds premiums, potentially reducing economic activity significantly. Furthermore, any shock that increases the information problems or reduces borrowers' net worth can set off the financial accelerator. For example, the fraudulent accounting practices at Enron that came to light cast doubts on the reliability of companies' accounts for determining their creditworthiness and growth prospects, and increased overall uncertainty about the credit risk of borrowers. The ensuing scrutiny of borrowers' positions increased the cost of borrowing for many firms by lowering their market valuation (net worth) because of sell-offs in equity markets.

6.2 Financial accelerator arising from commitment problems

Another approach emphasizes the potential for strategic default by borrowers. Strategic default occurs when borrowers choose not to repay a loan even though they may have the funds to repay it. This can happen when the cost of repaying debt is high relative to the cost of defaulting (for example, bankruptcy costs or restricted access to funds in the future). This limited ability to commit to debt repayment when the funds exist to do so has to be taken into account when lenders and borrowers write lending contracts. That is, lending contracts must provide incentives for borrowers to repay a loan. One way of doing this is to require that borrowers post collateral that lenders can seize in the event of a default. A firm's borrowing is then constrained by the value of the assets it can pledge as collateral, and the value of collateral in turn depends on the prices of pledgeable assets. A firm's assets may be used both as inputs to the production process and as collateral. An example is real estate: one can farm or build factories on land and, at the same time, use land as collateral for loans. The pledging of assets used as inputs creates a link between a firm's debt capacity and its investment. The higher a firm's desired investment and output, the greater is the firm's demand for assets that can serve as inputs as well as collateral. The higher the demand for assets, the higher is the price of assets, and the greater the value of the firm's collateral and its debt capacity. This is a financial accelerator at work in the positive direction. Unfortunately, it can work the other way as well. For example, a drop in the prices of assets used as collateral reduces the ability of firms to borrow and reduces their investment level if they do not have the internal funds to make up the shortfall. This reduction in investment in turn lowers the overall demand for assets and sends asset prices down lower, which further reduces the ability of firms to borrow.

The effect of the financial accelerator on the real economy is twofold. First, since the net worth of borrowers is likely to change in the same direction as the level of economic activity, the financial accelerator exacerbates an existing real business cycle. Second, shocks to the net worth of borrowers can initiate a downturn in the real business cycle. One implication of these models is that the impact of the financial accelerator tends to be more pronounced in an economic downturn than in an upturn. This is because the financial accelerator exists only when firms face borrowing constraints, which translate into investment constraints. In a downturn, an increasing number of firms become credit-constrained, making the effects of the financial accelerator more potent. During an economic upturn, the cost of borrowed funds falls, and the debt capacity of firms increases as their balance sheet positions improve. More and more firms will be able to undertake investment plans that are not constrained by the amount of funds they can borrow. Their investment level is also less affected by the external-funds premium. The weaker the link between the cost of funds, or debt capacity, and investment levels, the less important the financial accelerator is.

6.3 Discussion and policy implications: Financial accelerator

This approach is important because it provides a link from financial crises to substantial losses in terms of real output. It also shows that a financial crisis can be precipitated by, and can exacerbate, asset-price instability. These explanations do not deal with the causes of crises but with the channels through which financial crises can affect the macroeconomy, so they do not offer policy advice for crisis prevention. They do, however, offer advice for limiting the costs of crises. They suggest that measures to counter an economic downturn should be more aggressive than they would be in the absence of a financial accelerator. In particular, there is a role for monetary policy in resolving financial crises. Expansionary monetary policy can offset the effects or even reverse the direction of the financial accelerator. Since the effects of the financial accelerator are likely to be more pronounced in an economic downturn, fiscal and monetary easing should be more aggressive during an economic downturn that involves financial-accelerator effects than tightening should be during an upturn. An inflation-targeting central bank that does not recognize a financial accelerator that is underway can overshoot or undershoot the target. Therefore, central banks should be sensitive to the possibility of a financial accelerator in the economy as they undertake monetary policy actions.

7. Conclusion

The economic literature on financial crises identifies: (i) the sources of financial instability, (ii) the triggers of financial crises, and (iii) the extent to which policy-makers can mitigate crises. Crises can be mitigated by (a) eliminating the sources of fragility, (b) reducing the occurrence of triggers, and (c) reducing the extent of crises when they occur; that is, containing them. Tables 1 to 3 provide a summary of the literature in terms of what they say about (i) to (iii).

We could evaluate each approach that researchers have taken in the literature according to how well it explains crisis initiation and propagation, and how well it fits the stylized facts. It is clear, however, that each approach typically focuses on either the initiation or the propagation aspect of financial crises, and that each explains only a subset of the stylized facts. Indeed, each was developed to explain different aspects of financial crises. For example, the financial-accelerator approach seeks to explain the connection between financial events and the real economy, whereas the other approaches examine the initiation of financial events more closely and ignore the real economy. Contagion explanations abstract from initiating factors of crises and investigate only the propagating factors, while coordination-failure models focus on the initiating factors. Furthermore, all the approaches are partial in nature and leave some aspects of economic behaviour unexplained. In particular, most of them neglect the existence of markets for financial assets. We need to look at the literature as a whole to gain some understanding of financial instability and crises. Looking at only isolated parts will yield an unsatisfactory picture.

Although economists have been able to shed some light on the origins of financial instability and crises, they have not yet provided us with a complete understanding of financial crises. Not enough work has been done to advance our understanding of financial systems, which consist of both financial markets and institutions, and how the interaction between the two affects the real economy in terms of their ability to ameliorate or exacerbate financial crises. Most explanations of how financial markets work ignore financial institutions, while explanations of banking ignore asset markets. Consequently, we do not have a clear understanding of how households choose to invest their wealth: whether through banks that act as intermediaries or more directly through financial markets. Furthermore, we need to fine-tune our understanding of how all the sectors of the economy (final-goods markets, labour markets, banking markets, asset markets, and monetary and fiscal authorities) interact dynamically. Such an approach is called dynamic general-equilibrium theory. Researchers, however, have not yet been able to incorporate a financial sector with a meaningful role in overcoming frictions among market participants into this type of model. To better understand the origins of financial instability and the development of financial crises, we require theories that can investigate the interactions between financial markets, intermediaries, and the real economy, as well as their implications for financial stability.

Despite the incompleteness of the economic literature for explaining financial instability and crises, policy-makers must take measures to safeguard the economy from the effects of financial instability, even while economists are working on the frontiers of knowledge to further our understanding of the area. To make good decisions, policy-makers should understand the current literature and its implications as fully as possible, while relying on expert judgment to fill in the gaps.

Table 1: Sources of Financial Instability

Crisis initiation	• Self-fulfilling belief among depositors that others will withdraw their deposits in the short term (coordination failure) • Ineffectiveness of markets to provide liquidity to solvent but illiquid banks because of lack of information or market power among liquidity-providers
Crisis propagation	• Doubt of bank solvency triggered by the failure of other similar banks (informational contagion) • Credit exposures among banks that cause their pay-offs to be interrelated (contagion caused by credit links) • Debt financing in credit markets with imperfect information and contractual problems (financial accelerator)

Table 2: Triggers of Crises

"Sunspots"	• Can create arbitrary shifts in depositors' expectations, which trigger bank runs
New information	• Can cause self-fulfilling expectations of a bank run • Can result in contagion among banks that appear to be similar
Productivity shocks	• Can cause self-fulfilling expectations of a bank run • Can lead to contagion in the presence of credit exposures among banks • Can trigger the financial accelerator
Financial shocks	• Declining asset prices can turn bank liquidity problems into solvency problems and lead to contagion • Can trigger the financial accelerator

Table 3: Implications and possible policy instruments[a]

Eliminating/reducing coordination failure	Deposit insurance Suspension of convertibility Transparency Taxing early withdrawals Bank capital requirements Subsidized lending to and recapitalization of banks
Ensuring efficiency of markets for liquidity	Injection of liquidity through repurchase agreements Enforcing bank investment in liquidity through monitoring Capital requirements
Reducing contagion risk	Bailout guarantees Lender-of-last-resort operations Collateral requirements for participation in payments systems Restricting credit exposures among banks
Reducing impact of the financial accelerator	Counter-cyclical monetary and fiscal policies

[a] In practice, the decision to use these instruments would also depend on other considerations, such as the possibility of promoting inappropriate risk-taking by banks. Policy actions can often be associated with costs in terms of distortions to the economy or the introduction of perverse incentives.

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A Review of Notable Financial-Stress Events

Mark Illing

I benefited from the insight of Dinah Maclean, John Chant, Clyde Goodlet, Fred Daniel, Alexandra Lai, and other colleagues.

1. Introduction

This essay provides some context for the theoretical discussion of financial stability presented in the essay by John Chant by examining four key episodes of financial stress using a case study approach. The episodes chosen highlight the numerous dimensions of financial stability and the diversity of shocks that can strike the financial system. Because of this diversity, policy-makers must tailor the tools at their disposal to specific situations, sometimes in a matter of days or hours. As a result, each episode has helped shape financial system policy in a meaningful way.

2. The Stock Market Crash of October 1987

The stock market crash of October 1987 resulted in the most dramatic single-day decline in share prices in history. The rapid decline in equity prices then created difficulties for certain financial institutions, in particular many securities dealers, and left a large number of trades pending, owing to a lack of buyers.

Rather than distinguishing between solvent and insolvent financial firms, many institutions decided to restrict the lending of funds for liquidity purposes to a wide range of other financial institutions; an example of a failure in the market for liquidity. (See the essay by Alexandra Lai.) A second concern at the time was that the fall in equity prices would impair financial institutions' balance sheets, thereby limiting their ability to provide credit to the broader economy, which could have had deleterious effects on capital spending. This concern was based on memories of the 1929 stock market crash, which impaired the U.S. banking system and contributed to a collapse in real investment. The propagation of a shock from the financial system to the real economy in this manner is captured by the financial-accelerator models discussed in Lai's essay.

2.1 The market crisis

In the months leading up to October 1987, investors became increasingly uncertain about the sustainability of high equity prices. On 19 October, a combination of factors brought these concerns to a head and triggered a surge of selling activity and a sudden collapse in prices (Charts 1 and 2). The Dow Jones Industrial Average fell 22.6 per cent, the largest single-day decline in history. Over US$1 trillion in wealth, equal to about 22 per cent of U.S. GDP, was wiped out as a result. The initial magnitude of the crash was eerily similar to that of October 1929, when the Dow fell by 23 per cent over two consecutive days, eliminating a comparable share of America's wealth.[1]

Chart 1

1987 Stock Market Crash

Friday 16 October 1987 = 100

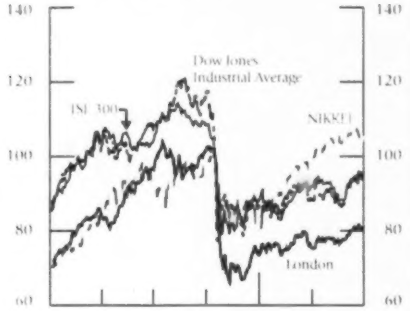
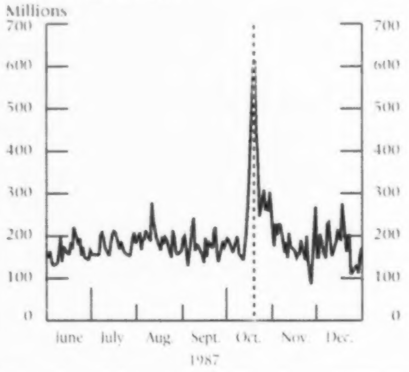


Chart 2

1987 Stock Market Crash

Volume of shares traded



The October 1987 crash was reflected simultaneously in markets around the world (Chart 1). For example, the TSE 300 fell by over 17 per cent in two days, eliminating about Can$50 billion in market capitalization, or about 8 per cent of GDP. The London FTSE and Frankfurt DAX dropped by about 10 per cent each on 19 October, and several hours later when Asian markets opened, the Nikkei fell by almost 15 per cent. Overwhelmed by the speed of price declines, Hong Kong closed its stock market for an unprecedented four days.

The crash has been attributed to several factors, although none explains why the decline took place over just a few days. Stock prices had risen rapidly over the three previous years and stocks were likely overvalued,[2] meaning that the probability of a sell-off was higher than normal. What caused the shift in expectations that triggered the bursting of this bubble remains a subject of debate, however.

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[1] The 1929 crash was also followed by a severe bear market. By 1932, the Dow Jones Industrial Average had declined a total of 89 per cent from its 1929 peak. It took until November 1954 to regain pre-crash levels. In contrast, the stock market bottomed out the day of the crash on 19 October 1987.

A number of other factors have been suggested as also contributing to the stock market crash (Davis 2002). The U.S. current account deficit and the expected federal budget deficit were both at historic highs, which put upward pressure on inflation expectations and, as a result, on long-term U.S. interest rates. At the same time, the U.S. dollar had rapidly depreciated against the Japanese yen and German mark following the 1985 Plaza Accord. The reversal of this decline, as agreed upon in the Louvre Accord, required a further tightening of U.S. financial conditions. Over the 12 preceding months, real money growth[3] slowed from over 14 per cent to a standstill—the largest and fastest one-year decline in U.S. money growth during the 1960–2001 period.

Most commentators blame the *severity* of the crash on heavy selling by large institutions, which accounted for two-thirds of the volume of trading at the time (Greenspan 1988, 221). In particular, the pervasive use of program trading and portfolio-insurance strategies, facilitated by the growing use of computer technology, accelerated the pace of selling. Under normal conditions, these new technologies increased trading efficiency by automating buy and sell orders to carry out the strategy of an investor. For example, a portfolio-insurance strategy could protect an investor by automatically selling a stock in the investor's portfolio if its price fell below a certain threshold. However, as many investors pursued this strategy, a sharp price decline triggered a cascade of selling. The volume of sell orders strained the stock exchanges' processing systems. On Friday, 16 October 1987, a record 338 million shares traded on the NYSE, surpassing the previous record by 10 per cent. Then, on the following Monday, the market was flooded by 604 million traded shares, more than triple the average daily volume at that time (United States General Accounting Office 1997, 61). Fearing a market seizure and potentially greater losses, investors attempted to off-load even more of their portfolios. For a time, the NYSE had only sell orders and contemplated closing its doors (*ibid.*, 65).

The extreme price movements in the spot market translated into even larger swings in derivatives markets. The pace of selling—described by many as a panic—caused participants to withdraw from trading. Many options transactions were slowed or suspended, which resulted in a high degree of market illiquidity. The imbalance of selling and the lack of liquidity resulted in a breakdown of the arbitrage process between the spot and derivatives markets.[4] As a result, equity futures prices became disconnected from their spot prices, trading at a heavy discount, and options prices no longer reflected fundamental risks.

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[2] For example, the trailing price-earnings ratio for the S&P 500 was above 22 just before the crash, compared with its historical average of around 16.

[3] Year-over-year growth of M1 divided by the GDP chain-linked deflator (January 1987 to December 1987).

2.2 The threat to financial stability

The immediate threat to financial stability on 19 October 1987 was the potential for widespread failure of securities firms and the consequent impairment of loans from the banking system to this sector. Because of the unprecedented declines in prices and the rapid pace of selling, securities firms issued large margin calls to their clients. In the interim, securities firms needed to borrow substantial funds from the banking system to cover the margin shortfalls. Uncertainty as to whether these margin calls would be met resulted in a general reluctance to extend credit and therefore put upward pressure on short-term borrowing rates. A similar pattern of credit tightening had also been observed immediately after the stock market crashes of 1907 and 1929.

As mentioned above, the U.S. stock market collapse also spilled over to equity markets around the industrialized world. There were, of course, fundamental reasons why prices between these markets should be highly correlated. However, the sell-off in the United States exaggerated normal market linkages as securities firms liquidated their foreign assets to meet U.S. collateral requirements (Davis 2002). The sudden collapse in global equity prices threatened the health of the world economy through two main channels. First, to the extent that household consumption is influenced by the household's stock of wealth, some of which is held directly in equities or indirectly via pension and mutual funds, the significant decline in asset values threatened to depress domestic consumption. This is known as the "wealth effect." Second, the collapse in asset values weakened the balance sheets of creditors and the market worth of debtors, thereby threatening to curtail the amount of capital available for business investment (the credit effect).

2.3 The short-term policy response

First, policy-makers had to ensure that the supply of liquidity in vital clearing and settlement systems was sufficient to meet increased demands. This would reduce the probability that liquidity-constrained financial institutions would have to sell assets at distressed prices in order to complete transactions.

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[4] Arbitrage is the process of simultaneously buying an asset in one market at a relatively low price and selling the same asset in another market at a relatively high price. Arbitrage trading forces prices between markets of essentially the same financial instrument to converge and thus involves processing a large volume of transactions to turn a profit. When there is a lack of buyers or sellers, because of extreme uncertainty or an imbalance in trading, arbitraging becomes more expensive, and larger price differentials will be observed.

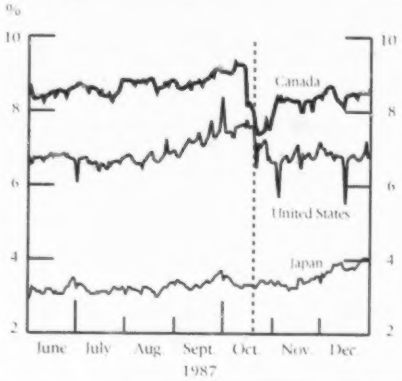
Most central banks decided to supply, or leave open the possibility of supplying, unusually large amounts of liquidity. The Fed, in particular, acted with much more transparency than normally accompanies its open market operations. Before markets reopened on 20 October, the Fed issued a simple, unambiguous statement:

> The Federal Reserve, consistent with its responsibilities as the nation's central bank, affirmed today its readiness to serve as a source of liquidity to support the economic and financial system (Greenspan 1987).

The New York Fed engaged in substantial, highly visible, and earlier-than-normal open market operations almost immediately, and for each day until 30 October.[5] As a result, the overnight federal funds rate fell 114 basis points between Monday, 19 October and Wednesday, 21 October (Chart 3).[6] This contrasts with the stock market panics of the nineteenth and early twentieth centuries when short-term interest rates jumped up sharply. The Fed also extended the operating hours of the federal funds transfer system on 19 and 20 October and lifted per-dealer lending limits.[7]

Chart 3

Overnight Interest Rates



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[5] Federal Open Market Committee transcripts of staff statements, "Notes for FOMC meeting November 3, 1987," by S.Y. Cross.

[6] The target federal funds rate was officially lowered from 7.5 per cent to 6.75 per cent in early November.

[7] *ibid.*

Like the Federal Reserve, other central banks issued reassurances that sufficient liquidity would be provided to keep payments and credit flowing smoothly, thereby supporting financial stability. As a result of this additional liquidity, overnight borrowing rates fell. The decline in interest rates also served to mitigate the negative effects that the stock market crash was expected to have on the real economy. The Bank of Canada pushed the Bank Rate down by 160 basis points. The Bank of England and the Bundesbank reduced their rates somewhat less aggressively, while the Bank of Japan, foreseeing a much smaller economic fallout, did not ease rates.

The Bank of Canada contacted the major Canadian chartered banks, dealers, exchanges, and securities commissions before the start of business on Tuesday to inform them that the Bank intended to inject extra liquidity into the banking system.[8] This involved the provision of very generous cash reserves, reinforced by $400 million in special purchase and resale agreements on 20 and 21 October (Tuesday and Wednesday).

In addition to the liquidity announcement, senior Fed officials contacted their counterparts at major banks and clearing houses to convince them to keep extending credit for transaction purposes and to keep sending payments to securities firms (Greenspan 1988, 218). The Fed had no authority to compel them to do this, but was able to convince most institutions that it would be in their own best interests. The Fed also placed examiners in major banking institutions to monitor developments, in particular to watch for evidence of impending bank runs.[9]

At the time, the fall in stock markets was so alarming that some suggested the need for immediate intervention to support equity prices. Some proposed halting trading altogether until calm was restored. This option was rejected, however, since it would simply have shifted capacity to other markets: for example, from the spot market to the futures market or from New York to London.[10] Since all major markets were already under considerable strain, a shift in trading of this magnitude might well have overwhelmed them. In the end, markets were kept open, and they eventually stabilized with large buy orders initiated by major firms and institutional investors.[11]

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8. As reported in the address by John W. Crow, Governor of the Bank of Canada, to La Chambre de Commerce de Montréal, Quebec on Tuesday, 3 November 1987.
9. Unlike the U.S. Federal Reserve Banks, the Bank of Canada is not responsible for supervising banks.
10. Indeed, the Chicago options market came under significant strain because of the large increase in trading activity. In response, the Fed waived a regulatory rule that restricted Continental Illinois National Bank and Trust Company from lending to its subsidiary, First Options, which was the largest options market-maker at the time (United States General Accounting Office 1997, 66).
11. The Securities Exchange Com (SEC) modified its rules to allow companies greater leeway in repurchasing their own securities.

2.4 Long-term perspective and lessons

Owing to the swift injection of liquidity by central banks and the resulting reduction in interest rates, the effects of the stock market crash on the real economy were minimized. In fact, real gross domestic product in the fourth quarter of 1987 increased at an annual rate of 6.9 per cent in the United States and 5.1 per cent in Canada. Economic growth was also very strong in 1988, averaging 4.2 per cent in the United States and 4.9 per cent in Canada. The Dow Jones Industrial Average and the TSE 300 returned to their pre-crash peaks within 21 months, "no major brokerage firms failed, unprecedented margin calls by the futures clearing houses were met by their members, and stock prices reached a new trading range shortly after the plunge" (Greenspan 1987, 222).

The Task Force on Market Mechanisms, which was established to investigate the crash, criticized computer-driven trading practices for triggering the slide in prices (Brady 1988). Nevertheless, the Fed argued that these new technologies promised greater trading efficiency in the future. The Fed urged private exchanges to implement their own solutions, such as developing "circuit breakers" to halt trading in a specific stock for a set period of time if its price should fall by a pre-determined amount. Most major exchanges around the world have since adopted rules of this nature. By interrupting the price-discovery process, these rules imply a trade-off between on-exchange and off-exchange price volatility, and are thus controversial.

The Task Force recommended the creation of a common regulator for stock, futures, and options exchanges in the United States, since prices in these markets are a function of one another. The Fed declined to take on these overriding regulatory responsibilities because it felt they were beyond the scope and mandate of a central bank. The regulatory regime of the U.S. financial system is still spread out over many agencies, including federal and state banking supervisors (who oversee the activities of securities firms owned by bank holding companies), the SEC, and the Commodity Futures Trading Commission (CFTC). Moreover, many privately negotiated derivatives contracts (mostly swaps) are negotiated in offshore banking centres that are subject to minimal regulation.

Debate continues regarding the influence that changes in asset prices have on the economy and inflation, via wealth and credit effects, and whether and how central banks should respond to asset-price declines. Since the Bank of Canada has an explicit inflation-control target, the response to asset-price movements depends entirely on the perceived broader inflationary or deflationary implications. This should not be confused with a desire to support a particular level of asset prices, even during a market crash.

3. The Collapse of Long-Term Capital Management

One of the most dramatic cases of stress in the market for liquidity occurred in the autumn of 1998. Markets failed in the sense that even creditworthy borrowers were faced with much higher borrowing costs. The failure can be attributed to a lack of information that made it difficult for creditors at the time to distinguish between sound and unsound borrowers.[12] The crisis was a prime example of financial system contagion since it spread through global markets and between assets that seemed to be unrelated. The crisis came to a head with the collapse of Long-Term Capital Management (LTCM), which, at the time, was the largest hedge fund in the world.

A hedge fund is an investment pool—similar to a mutual fund—that caters to wealthy individuals and institutions.[13] Unlike mutual funds, hedge funds are not subject to strict investment guidelines. They can engage in riskier and more leveraged investment strategies, such as short selling assets and underwriting options.[14] LTCM was four times larger than its biggest competitor. It had over 60,000 trades pending on its books, of which 10,000 were swaps;[15] over US$1.25 trillion in notional exposure via swap agreements, futures, options, and other derivatives;[16] and its assets were leveraged 25-fold to its capital base.

Unlike major banks and securities firms, hedge funds are not directly regulated in most countries, including Canada and the United States, because their investors and counterparties are assumed to be financially sophisticated. For example, LTCM disclosed its notional balance-sheet exposures and bilateral positions, but its off-balance-sheet exposures and combined positions with over 36 counterparties were unknown risks. In such cases, the onus is on investors and counterparties to assess the risk of the institution based on the information it discloses. The risks that LTCM was taking, combined with the opaqueness of its operations, meant that its creditors—many of the largest banks in the United States—had not properly assessed the extent of their own potential losses.

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[12] This implies a higher risk of error, which justifies the higher cost of credit.

[13] The SEC limits U.S. hedge funds to 99 investors, at least 65 of whom must be "accredited," which is usually defined as having a net worth of at least US$1 million (Van 2002). LTCM was even more exclusive, requiring its investors to commit a minimum of US$10 million for at least three years.

[14] Short selling involves borrowing an asset (often from banks in LTCM's case) in order to sell it immediately with the expectation that the asset can be bought back at a lower price and returned to the original owner at a later date. If the asset's price increases over this interval, however, it must be bought back at a loss. Underwriting options is similar to selling insurance. It involves selling contracts that give the purchasers the right to buy or sell an asset at a prespecified price (the strike price). The underwriter takes the risk that the strike price will be triggered and it will incur a loss on the transaction.

[15] A swap is an arrangement whereby two parties agree to exchange payment flows on assets in the future without actually exchanging the underlying assets.

[16] Notional exposure refers to the face value of the assets underlying the derivative contracts. The actual value at risk is typically a fraction of the notional exposure.

LTCM was able to garner such trust because it was led by prominent principals, including two Nobel prize winners and a former Vice-Chairman of the Federal Reserve Board,[17] and because it generated considerable profits in the first three years of its existence, with returns on equity of 42.8, 40.8, and 17.1 per cent in 1995, 1996, and 1997, respectively. As a result, the fund attracted many wealthy investors and had easy access to credit from major banks and trading counterparties, perhaps with less than the usual degree of scrutiny (Report of the President's Working Group 1999, 15). For example, LTCM was able to engage in interest rate swaps at preferred rates with no initial margin and could borrow all of its collateral without a haircut[18]—which allowed the fund to leverage itself to a potentially unlimited degree.

LTCM made most of its profits by buying or selling government bonds, index spreads,[19] and total return swaps[20] in order to "arbitrage" price deviations. Although the term arbitrage is commonly used for this type of trading strategy, it is not pure arbitrage in the classical sense (see footnote 4), since it involves meaningful risks. Essentially, LTCM was betting that price differentials (spreads) would return to their historical norms, at which point, the bonds could be either sold or bought back, or the derivatives unwound, at a profit. For example, LTCM would "buy theoretically underpriced off-the-run U.S. Treasury bonds (because they are less liquid) and go short on-the-run (more liquid) Treasuries. It played the same arbitrage game in the interest rate swap market, betting that the spread between swap rates and the most liquid Treasury bonds would narrow" (Shirreff 2001).[21] The extent and complexity of these trades made it difficult to know the true scope of LTCM's risks at any one time.

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[17] Hedge funds are usually headed by one or more general partners, or "principals," who direct the fund's overall investment strategy and usually have part ownership. The principals usually receive 20 per cent of the profits in addition to a fixed management fee, usually 1 per cent of the assets under management (Van 2002). LTCM's principals included the Nobel Laureates Robert Merton and Myron Scholes, John Meriwether (former Vice-Chairman and head of global risk management at Salomon Brothers), and David Mullins (former Vice-Chairman of the Federal Reserve Board, 1990–94).

[18] When the value of collateral exceeds the value of a loan, the difference is called a haircut. The haircut provides the lender with a margin of protection in the event that the value of the collateral falls.

[19] An index spread is the difference between two indexes that represent the same or very similar underlying assets; for example, the difference between the spot and futures indexes for a stock market.

[20] A total return swap involves the owner of an asset agreeing to pay a counterparty all of the returns to that asset over a specified period of time, which could include any capital gains or losses, interest payments, dividends, principal repayments, etc. The assets underlying total return swaps are typically equity indexes, loan portfolios, and single stocks, bonds, and loans. In return, the counterparty pays the owner of the asset a stream of cash flows based on short-term interest rates. The swap allows the owner to retain ownership of the asset but to receive a less-risky stream of payments. The counterparty receives the total returns, which are expected to be more volatile but to have a higher return.

3.1 The liquidity crisis

Part of LTCM's undoing was that most of its decisions to buy and sell were based on complex mathematical models that, in turn, were based on historical price relationships in financial markets. In August 1998, prices deviated substantially from those historical relationships, beyond the probabilistic scenarios considered by the models. The extreme price movements were initiated by Russia's debt default on 17 August. The default was a major surprise to markets, and capital began to flow out of emerging markets' securities, which were now deemed to be much riskier than previously thought, and into advanced markets' securities, especially into U.S. Treasuries. This phenomenon is often called a "flight to quality," whereby a premium is placed on the most liquid and lowest-risk assets, such as on-the-run U.S. Treasuries. Liquidity premiums rose to persistently high levels, a risk that LTCM had been betting against.

The flight to quality was not limited to emerging markets. Russia's default and the subsequent devaluation of the ruble accelerated the decline in global commodity prices, because investors expected the country to flood world markets with cheap exports. The currencies of other major commodity exporters, such as Canada, came under intense downward pressure. This affected expectations and as a result pushed up long-term interest rates. The Bank of Canada responded to the incipient loss in confidence by raising its target rate by 100 basis points to 6 per cent in late August (Charts 4 and 5) (Thiessen 1998). Although the linkages among the various markets appear evident today, LTCM's models had not anticipated such a strong correlation among such diverse markets.

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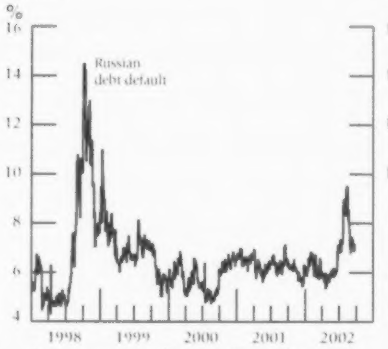
[21] "On-the-run" U.S. Treasuries are the most actively traded issues of U.S. government debt (typically the most recent issue) and are therefore readily sellable for cash in the market. "Off-the-run" Treasuries are less-recent issues that have seen a decline in trading activity as they find their way into long-term investors' portfolios.

Chart 4

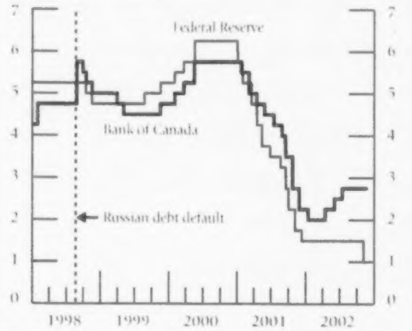
One-Month Implied Volatility, Canadian Dollar*



* One-month implied Canadian-dollar volatility derived from at-the-money call options for US$/Can$

Chart 5

Target for the Overnight Rate and Target for the U.S. Federal Funds Rate

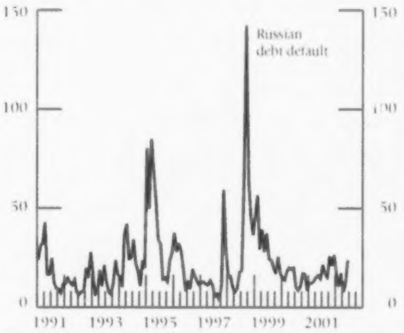


Movements in financial asset prices also became much more volatile and more correlated than before, in particular those of emerging-market government bonds (Chart 6). This triggered selling by other investors, notably large investment banks, who had imposed limits on their exposure to specific assets based on how volatile and correlated their price changes became as measured by a technique known as Value-at-Risk portfolio management.

Chart 6

Volatility of Emerging-Market Bond Index

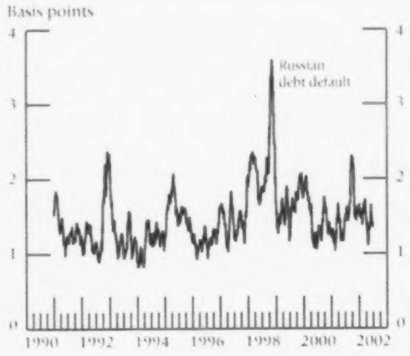
6-week annualized volatility
Basis points



LTCM had counted on being able to easily unwind its positions in the markets. But because the fund was a lead participant in so many markets, its actions were sufficient to move market prices. Meanwhile, other hedge funds and institutional investors were engaged in similar investment strategies and were trying to unwind similar positions. Again, these positions were held under the

Chart 7

Bid-Offer Spread for 90-day Canadian Treasury Bills



assumption that they could be unwound without moving prices. This assumption proved to be false, since markets were not sufficiently liquid. This raised trading costs in even the most developed debt markets; e.g., the bid-offer spread on Canadian treasury bills in Chart 7.[22]

As LTCM's losses accelerated, the major banks that had extended it credit grew concerned that their loans would not be repaid.[23] Other market participants became increasingly reluctant to extend credit to LTCM and other hedge funds with similar characteristics. As a result, creditors began to demand more collateral. Higher collateral requirements then forced LTCM to unwind even more of its positions. This, in turn, moved market prices further from their norms.

3.2 The threat to financial stability

After about one month, LTCM's losses exceeded its capital base of US$4.8 billion (i.e., the fund's owners had lost their entire investment at that time). The fund was also nearly out of cash, and its collateral requirements had increased substantially. When it seemed that LTCM was about to default on its obligations, its principals approached the Federal Reserve Bank of New York for

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22. Bid-offer spreads are one indicator of market liquidity. The spread represents the difference between the prices quoted by a middle man (the market-maker) to the buyer and seller of a security.

23. During quickly evolving periods of extreme market volatility, it can be very difficult or even impossible to determine whether or not a debtor is solvent. In borderline situations, it may therefore be rational for a bank to err on the side of caution and deny credit.

guidance.[24] The New York Fed was not prepared to lend LTCM the short-term funds it required. Not only was LTCM not on the list of approved borrowers for the Fed's discount window, but the Fed had no way of ascertaining whether the fund was actually solvent.

LTCM had borrowed heavily from the largest banks and securities firms operating in the United States, which did fall under the auspices of the New York Fed. It is estimated that had LTCM defaulted, its 17 largest counterparties would have incurred direct losses of as much as US$300 to US$500 million each, or US$3 to US$5 billion in aggregate (Report of the President's Working Group 1999, 17).

In and of themselves, these exposures were not large compared with the creditors' capital bases. However, the creditors had indirect exposures to LTCM through multiple layers of swaps and options contracts that were too numerous and complex to be calculated. Their ultimate exposures were therefore unknown. Furthermore, a complete unwinding of LTCM's assets[25] could have sparked a "fire sale" by other investors, further straining markets when risk premiums were already at a peak.[26] Such herding behaviour is a common factor in crises when there is an acute lack of information.

3.3 The short-term policy response

Recognizing the seriousness of this threat, the New York Fed arranged a meeting of LTCM's core creditors[27] to explore "mutually beneficial alternatives to default" (Report of the President's Working Group 1999, 13). The consortium of creditors met in the offices of the New York Fed and considered several alternatives, including liquidating the fund, selling it to an interested private investor, or recapitalizing it with their own money. The New York Fed dismissed a publicly funded rescue package as inappropriate.

In a matter of hours, the creditors had to decide whether to walk away from their losses or to risk more money in an attempt to rescue LTCM. Ultimately, 14 core creditors formed a consortium, and

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[24] This took place on 22 September. LTCM had informed its investors on 2 September that the fund had lost 44 per cent of its value in August (52 per cent year-to-date). Rumours to this effect had begun circulating in the market several days before.

[25] LTCM had cross-default terms on all of its loans, meaning that if it defaulted to a single lender it would trigger a default to all its lenders. This would force LTCM to liquidate its assets all at once.

[26] For example, the spread between long-term Canadian corporate and government bonds more than doubled in September, Eurodollar LIBOR bid/offer spreads were twice their average, and the bid/offer spread on 90-day Canadian treasury bills (see Chart 7) shot up to its highest level on record.

[27] LTCM's major creditors were, in alphabetical order: Bankers Trust, Banque Paribas, Barclays, Bear Stearns, Chase, Crédit Agricole, Credit Suisse First Boston, Deutsche Bank, Goldman Sachs, Lehman Brothers, Merrill Lynch, Morgan Stanley, Salomon Smith Barney, and Société Générale.

11 of them advanced US$300 million each to recapitalize the fund (for a total of US$3.625 billion) in exchange for 90 per cent ownership and operational control.

The new capital was used to pay off LTCM's short-term obligations. This allowed the fund to continue operating for about 15 months until it could liquidate its assets, close out its derivatives contracts, and pay off all its debts. The consortium members were able to recoup their capital and eventually even turn a profit. In 1999, the fund redeemed the shares of its original investors. The yield to investors over the total life of the fund was about 19 per cent on an annual average basis, taking account of capital that was returned to investors before the crisis (Shirreff 2001). In contrast, the S&P 500 (a considerably less-risky alternative for investors) returned an average of almost 27 per cent over the same period.

Although the Fed did not directly intervene in LTCM's rescue, it did respond to the extreme degree of illiquidity in certain financial markets. In a succession of reductions, the Fed lowered its target for the federal funds rate by three-quarters of a percentage point before the end of the year, including once between regularly scheduled meetings. The Bank of Canada also lowered its target for the overnight rate three times between September and November.

3.4 Lessons learned from LTCM

The primary lesson learned from the collapse of LTCM is that excessive leveraging by financial entities combined with a lack of transparency to creditors can lead to a liquidity crisis when extreme events take place. To address this problem, the President's Working Group on Financial Markets (1999) made numerous recommendations, the most important of which was that there should be greater disclosure of financial positions by hedge funds and their counterparties. In March 2000, the U.S. House of Representatives passed the Hedge Fund Disclosure Act, bringing this recommendation into law.[28] The act requires unregulated hedge funds with consolidated assets of $3 billion or more to submit quarterly reports to the Federal Reserve. These are then made available to the public. The objective of the legislation is to improve market discipline by providing more complete information to investors. The act did not go so far as to regulate the hedge fund industry, however. Under separate regulatory changes made by the SEC, CFTC, and other U.S. federal agencies, regulated financial institutions must now disclose more information to their regulators about their counterparty exposures to these entities.

Disclosure is just the first step in mitigating financial market stress. As a result of the Asian and Russian financial crises, the Committee on the Global Financial System (made up of representatives from central banks, including the Bank of Canada) was formed and collects information to help it to assess potential risks in world financial markets. These episodes also resulted in the convening of the Financial Stability Forum in April 1999, "to promote international financial stability through information exchange and international co-operation in financial supervision and surveillance. The Forum brings together on a regular basis national authorities responsible for financial stability in significant international financial centres, international financial institutions, sector-specific international groupings of regulators and supervisors, and committees of central bank experts."[29] Meanwhile, in response to a range of events in which banks' lending practices resulted in significant losses, the Basel Committee on Banking Supervision has been working on global guidelines to improve counterparty risk management and make regulatory capital requirements more risk-sensitive.

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[28] U.S. House of Representatives, H.R. 2429 (16 March 2000).

4. Failures of Small Canadian Banks

Bank failures were common in Canada in the late 1800s (Chart 8). In the early twentieth century, however, it became more common for distressed banks to be bought out by stronger rivals, which produced the relatively concentrated and stable banking system that we have in Canada today. Indeed, after the collapse of the Home Bank of Canada in 1923, not a single Canadian bank failed for more than 60 years.

In the mid- to late 1970s, several small and primarily regionally based banks were chartered to compete with the large dominant banks in what some perceived to be underserved markets (Estey 1986).[30] But by 1985, three of these banks were in distress and subsequently collapsed—the Canadian Commercial Bank (CCB), the Northland Bank, and the Bank of British Columbia. The problems at these banks affected the ability of several other small but solvent banks to borrow on wholesale money markets. The Bank of Canada provided emergency loans to these institutions in its capacity as the country's lender of last resort (LLR).[31] LLR loans are intended to prevent informational contagion in the banking system, which derives from the assymetry of information between banks and their creditors (i.e., banks have inside information on the value of their assets, while creditors may have only incomplete information).[32]

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[29] At <http://www.fsforum.org>

[30] The CCB and Northland Bank's business plans were approved in 1975 by provincial and federal governments intent on promoting regional banking, especially in western Canada (Estey 1986).

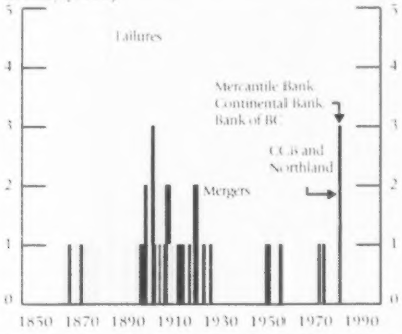
[31] Note that these loans are provided only to illiquid institutions that are judged to be solvent. For more on LLR see the essay by Fred Daniel.

[32] The bank and its creditors may also have divergent opinions on the value of the assets because of different investment time horizons and differing beliefs about the future.

Chart 8

Canadian Bank Failures and Mergers Over History

Author's calculations based on historical summary in Estey (1986)



4.1 Why did the banks fail?

This discussion focuses on the reasons for the failures of the CCB and Northland, because these institutions represented the bulk of public and private losses. Both were small institutions, which by mid-1985 had total assets of $2.7 and $1.4 billion, respectively. This represented a little less than 1 per cent of the Canadian banking system's assets and capital at the time. As Charts 9 and 10 illustrate, both banks concentrated their lending in western Canada. They expanded their loan portfolios rapidly, which resulted in a quadrupling of assets in the early 1980s (Chart 11). This was achieved by taking on considerable risk, however, in particular by lending to sub-prime commercial firms and speculative energy-related real estate projects. Given these portfolio concentrations, the CCB and Northland were especially vulnerable to the worldwide recession of 1981–82, which had a particularly strong impact on western Canada's oil patch.

In addition to these factors, the CCB and Northland both had weak corporate governance practices. Senior managers, the boards of directors, and the external auditors all failed to accurately acknowledge the financial risks inherent in their loan portfolios (Estey 1986).[33] Both banks were thus particularly vulnerable to failure.

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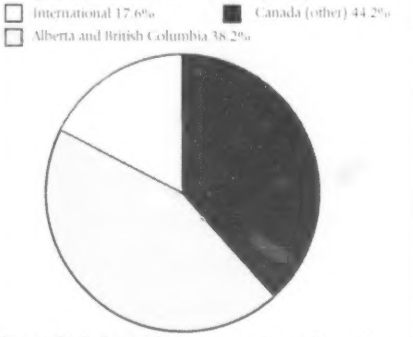
[33] Effective corporate governance was also hindered by numerous conflicts of interest. For example, Northland's directors and senior management had personal financial dealings with the bank, amounting to $7.5 million in loans to directors, and $2.1 million to senior officers. It was also not uncommon for both banks to be exceptionally generous with the conditions on loans to senior managers. For example, the CCB wrote off a $750,000 personal loan to its CEO Howard Eaton for a home in Los Angeles (Estey 1986).

Chart 9

Canadian Commercial Bank

Geographical distribution of loans (1981)*



*The geographic distribution of loans became more diversified between 1982 and 1984, but remained concentrated in the energy and energy-sensitive real estate sectors.

Chart 10

Northland Bank

Geographical distribution of loans (1984)

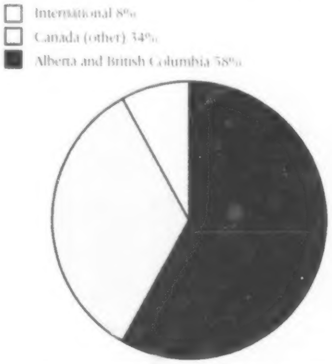
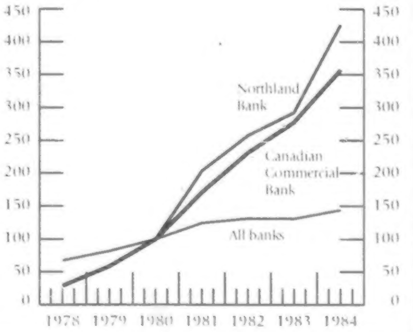


Chart 11

Total Bank Assets

1980 = 100



Nevertheless, the banks maintained the appearance of profitability and solvency by using aggressive accounting techniques, by exaggerating income, and by underreporting the poor quality of their loans (Charts 12 and 13). These techniques included overly optimistic assumptions about future loan quality, repayment probabilities, and economic conditions. When loans were not repaid, they were simply rolled over, and long-overdue interest payments were still recorded as expected income.[34]

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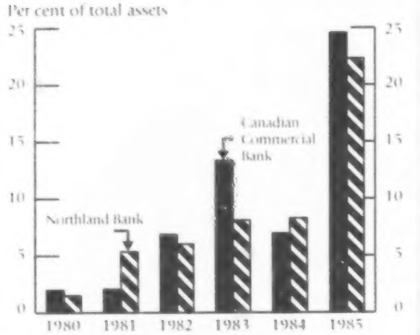
[34] For example, between 1982 and 1984 the CCB claimed an estimated $59 million in interest income that, in fact, had not yet been collected (Estey 1986).

Chart 12

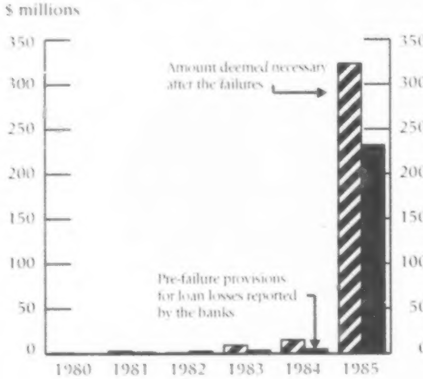
Non-Performing Loans



Note: 1985 figures are based on a consensus of various post-failure inspections, together with liquidator, auditor, and curator reports

Chart 13

Loan-Loss Provisions



Note: 1985 figures are based on a consensus of various post-failure inspections.

In addition, both banks began to classify a greater share of their lending income as "fees," even though these fees were merely an upfront substitute for interest and therefore should have been accrued over the life of the loan.[35] To sustain income levels year after year, this accounting technique required rapid growth in lending, since fees are typically received only in the first year that a loan is made. More conservative accounting practices would have easily wiped out all of the banks' profits and additions to retained earnings over the 1982–84 period. Despite their aggressive accounting practices, the CCB and Northland's financial statements were approved by their respective external auditors, who then forwarded them to the Office of the Inspector General of Banks (OIGB).

The unstable macroeconomic environment in the late 1970s and early 1980s also contributed to the failures. During this period, there were large swings in the world price of crude oil, the Canadian dollar, inflation, and interest rates, all of which had negative consequences for real economic activity and real estate prices. For example, the level of real GDP in Alberta did not fully recover to its 1981 peak until 15 years later, while house prices in Vancouver fell by almost 40 per cent from their peak in 1981 to their trough in 1982.

Significant and unexpected volatility in interest rates can be a threat to financial institutions that excessively fund assets bearing long-term interest rates with short-term deposits bearing variable interest rates. When interest rates-increase faster than expected, the spread between the cost of deposits and the return on assets can become negative. Moreover, funding long-term assets with shorter-term deposits leaves financial institutions vulnerable to liquidity problems. Wholesale money market deposits, which the regional banks tended to rely on, are particularly sensitive Wholesale deposits tend to be large and mostly uninsured, unlike retail deposits, and are therefore prone to sudden withdrawals (bank runs) when confidence in an institution is shaken. This, together with the banks' vulnerability to falling real economic activity and real estate prices, left them highly prone to liquidity shortages.[36]

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[35] For example, the CCB would charge an initial management fee to a borrower, which would simply be deducted from the loan, in exchange for a much lower stream of interest payments on the loan.

Finally, if bank supervisors had been more proactive, the problems at these banks might have been better contained. Under the former OIGB, bank supervision was considerably weaker than it is today. The OIGB relied upon external auditors and discussions with bank managers to inform them of impending problems. More in-depth analysis was limited by the fact that the OIGB had only 14 bank inspectors and analysts at the start of the recession in the early 1980s. More importantly, the Inspector General lacked sufficient legal authority to intervene forcefully in an institution's affairs when problems first became evident. The Inspector General could have closed an institution outright, but this required stringent proof of insolvency, which usually comes long after problems have taken root.

4.2 The reaction of markets for liquidity

The CCB had experienced difficulty accessing short-term funds from the market on several occasions prior to 1985. In fact, the CCB suffered from a financial scandal in late 1982 that prompted a run on its deposits. For several years, the CCB's CEO, Howard Eaton, had facilitated loans to certain Ontario trust companies controlled by or affiliated with one of Eaton's personal financial associates (Estey 1986). Eaton was finally forced to resign, but the scandal caused a loss of confidence. In January 1983, at the CCB's request and with confirmation of the bank's solvency from the Inspector General, the Bank of Canada announced that it would provide secured liquidity support to the CCB. At that point, the major chartered banks also created a liquidity facility for the CCB. The Bank of Canada's facility was ultimately not drawn down, and by June 1983, the CCB regained the confidence of financial markets.

Throughout 1984 and early 1985, however, there was renewed suspicion in markets that the CCB was unsound. In early 1985, U.S. regulators decided that the quality of the CCB's loans in its U.S.

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[36] That is not to say that these shocks did not affect the major Canadian banks. For example, from 1982 to 1985, 75 to 80 per cent of the Royal Bank's domestic non-performing assets were in Alberta and British Columbia ($1.245 billion out of $1.853 billion domestic loan write-offs between 1980 and 1985), and most of TD's 1984 loan losses of $924 million were in these provinces' resource and real estate sectors. However, these large banks had diversified portfolios, so that these losses represented a much smaller proportion of their total portfolio.

subsidiary had became so poor (one-third were classified as "doubtful and substandard") that the CCB was forced to take a Can$85 million loss.[37] This write-off prompted another run on the CCB's wholesale deposits, forcing it to seek emergency funds from the Bank of Canada.

4.3 The short-term policy response

Over a weekend in March of 1985, the Governor of the Bank of Canada (Gerald Bouey) met with government officials and the CEOs of the major chartered banks to deal with the CCB's imminent failure. A restructuring package was initially put in place for the CCB, whereby its non-performing loans were purchased for $225 million by a consortium, including the Canada Deposit Insurance Corporation, the six largest chartered banks, the governments of Alberta and British Columbia, and the Government of Canada. The Bank of Canada did not contribute funds to this package. As the lender of last resort, the Bank provides liquidity only to institutions judged to be solvent, and these funds must be fully collateralized. Once the support program was in place, however, the CCB was judged by the OIGB to be solvent, and a fully secured emergency liquidity facility was extended by the Bank of Canada.

When the emergency facility was announced on 25 March, the CCB had $291 million in wholesale deposits on its books. Within a month, this had fallen to $121 million. Other private sources of short-term funds also contracted sharply. As a result, the Bank of Canada's liquidity support rose from $85 million by the end of April to $540 million by the end of August, and eventually peaked at slightly more than $1.3 billion.

In April 1985, shortly after information about the CCB's facility was made public, money markets also lost confidence in the Northland Bank, suspecting that it was in a similarly unsound financial position. Faced with sharply higher costs for short-term funding, Northland also approached the Bank of Canada for liquidity assistance, which rose rapidly and eventually totalled more than $500 million. Later in the year, the Bank of Canada also made special advances to the Bank of British Columbia, Continental Bank, and the Mercantile Bank, peaking at almost $5 billion. These advances appear to have contained the ill effects of informational contagion. Indeed, shortly thereafter, these institutions were bought by larger, better-capitalized banks, and the advances were quickly repaid. However, the Canadian Deposit Insurance Corporation (CDIC) agreed to cover $200 million of the $975 million advance to the Bank of British Columbia, because the bank had actually been insolvent and not just illiquid.[38]

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[37] In 1979, the CCB began making loans related to the energy sector in California. The CCB also purchased a minority interest in Westlands, a small, financially troubled California-based bank. Ironically, Westlands ultimately survived.

4.4 The direct costs of the bank failures

After an in-depth inspection over the summer of 1985, the Inspector General discovered the CCB's and Northland's deceptive overstatements of income and assets. Even after transferring $255 million in non-performing loans (10 per cent of the bank's total loans) to the support consortium, almost one-third of the CCB's remaining loans were marginal or unsatisfactory, according to the bank's own estimates—about double the estimate for 1984. Based on a sample of large-value accounts, the inspection team found that 85 per cent of loans were weak or doubtful, and that almost 40 per cent of the portfolio would have to be written off. There was a similar outcome regarding the soundness of Northland's loan portfolio. Northland estimated that it might have to write off 5 per cent of its loans; however, later inspections by the bank's curators suggested potential losses of up to 20 per cent ($190.3 to $232 million on $1.183 billion in assets).

With no other bank interested in a merger,[39] the Inspector General declared both banks not viable on 1 September 1985. The Bank of Canada immediately cancelled the banks' liquidity facilities. The depositors of the CCB and Northland were fully reimbursed, even those who had amounts over and above insured limits.[40]

The direct costs of the failures included:

- $875 million in uninsured deposits reimbursed by the federal government.
- Over $316 million in losses incurred by the CDIC. After 10 years, only 42 per cent of the CCB's and 68 per cent of Northland's claims and loans had been recovered by the CDIC.[41]

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[38] In December 1985, the Mercantile Bank merged with National Bank. The Bank of British Columbia was bought by Hongkong Bank of Canada after the CDIC agreed to cover the former's advances. Finally, Continental Bank was bought by Lloyd's Bank. Lloyd's was purchased by Hongkong Bank shortly thereafter. Advances to Continental totalled $2.9 billion, $1.5 billion provided by the major chartered banks and $1.4 billion provided under a fully secured advance from the Bank of Canada. Lloyd's bank repaid the advances by mid-December 1986 after its takeover.

[39] Proposed mergers between the Royal Bank and the CCB, and the National Bank and Northland, were rejected after examinations by the potential acquiring banks revealed that the two regional banks were not just illiquid but also insolvent.

[40] The Financial Institutions Depositors Compensation Act (1985, c. 51) allowed for all uninsured depositors to be reimbursed with funds from the federal government's Consolidated Revenue Fund.

[41] On a net present-value basis the recovery rates were just 28 and 33 per cent, respectively. CCB claims and loans include those made to the CCB Mortgage Investment Corporation. Figures from the CDIC 1995/1996 Annual Report.

Deposit insurance premiums, which are levied by the CDIC on its member institutions, were increased as a result.

- $200 million paid to the Hongkong Bank of Canada by the CDIC to facilitate the takeover of the Bank of British Columbia.
- Lost interest and administrative costs associated with recovering collateralized advances to the Bank of Canada. Although it took until 1999, the Bank of Canada eventually recovered its advances through a lengthy liquidation of the collateral that had been pledged. Interest ceased to be paid once the institutions were declared insolvent in 1985.[42]

Therefore, the total direct cost of the banking failures was over $1,391 million, or 0.3 per cent of Canada's gross domestic product in 1985. The broader economic impact of the failures appears to have been negligible (Hoggarth, Reis, and Saporta 2001), because the bank failures did not disrupt macroeconomic credit conditions or raise risk premiums for the major Canadian banks.[43]

4.5 Long-term perspective and lessons

After the failures, the arrangements for banking supervision in Canada were substantively restructured. The OIGB was merged with the Department of Insurance into the Office of the Superintendent of Financial Institutions (OSFI). OSFI's mandate has changed markedly since the elimination of the OIGB. The former supervisor had operated under the expectation that it would prevent bank failures. Moreover, the legal framework made it difficult for the Inspector to close troubled banks owing to the onerous burden of proof of insolvency. In contrast, OSFI now has a policy and mandate of "early resolution," whereby it acts in a timely fashion to resolve potential problems at supervised financial institutions. In addition, the legal framework has changed to make the exit of troubled financial institutions less onerous.

A bank can now be closed at the supervisor's discretion before it falls into a negative equity position. This change has better aligned banks' incentives with those of regulators. For example, through their aggressive lending practices, the CCB and Northland assumed risks that were disproportionate to their small capital bases. But the OIGB could not close them until it could prove that their losses had in fact exceeded their capital. Now that OSFI has the power to close such an institution, banks have a strong incentive to pursue lending strategies that match their capacity to bear risk. Moreover, OSFI has the power to enforce this intervention through the use of directions of compliance.

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[42] By 1997, there was still $13.8 million in residual CCB advances on the Bank of Canada's books, and $1 million in Northland advances. These balances were finally cleared in 1998 and 1999, respectively.

[43] For example, the spread between 90-day Euro Certificates of Deposit on Canadian banks versus U.S. money-centre banks did not increase noticeably during this period. Also, Canadian financial institutions' yields on mid- and long-term bonds were at cyclical lows relative to government yields in 1985.

An information-sharing committee, known as the Financial Institutions Supervisory Committee (FISC), was also formed in 1987 between the Department of Finance, OSFI, the CDIC, and the Bank of Canada.[44] The collective interests at stake in the FISC provide incentives for timely supervisory intervention into troubled financial institutions. Early resolution helps the CDIC to minimize insurable losses and reduces the possibility that the Bank of Canada will lend to an insolvent institution.

The commission of inquiry into the bank failures, commonly referred to as the Estey commission, criticized the banks' external auditors for failing to apply sound accounting principles to the banks' financial statements. But it stopped short of recommending a change in Canada's bank-auditing process, because there was no persuasive evidence that alternative arrangements would have produced better results. Bank supervisors in some countries, notably the United States, carry out their own audits of institutions' books rather than rely on external audits. On the other hand, OSFI relies on external auditors to assess the accuracy of an institution's financial statements, although it may challenge and probe these assessments.

5. The Bank of New York's $23.6 Billion Computer Bug

Clearing and settlement systems are the networks and arrangements that allow financial institutions to transfer funds and assets among themselves, on their own behalf or on behalf of their customers.[45] On occasion, these systems experience interruptions owing to inadequate or failed internal processes, hardware, or communications lines, or to such things as human error, criminal acts, floods, or fire. Operational risk is a combination of the likelihood and severity of these kinds of interruptions. Most financial transactions in large-value payment systems are now processed and settled by computers in real time. This has eliminated the sometimes lengthy time lags associated with manual clearing systems, but the interruptions that do occur can quickly result in large backlogs with very little time to correct errors. Recent examples of operational risk include the feared disruption of services around Y2K and the actual disruptions following the terrorist attacks on 11 September.[46] One of the first major operational failures to threaten the modern financial system occurred in November 1985 as a result of a computer bug at the Bank of New York.

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[44] The Financial Consumer Agency of Canada now also participates on the committee.

[45] The Bank of Canada's Web site contains an informative elaboration on payments systems, <http://www.bankofcanada.ca>.

The Bank of New York was, and still is, one of the largest custodial banks in the United States.[47] This means that it handles transactions of securities on behalf of its clients, mostly foreign banks and corporations. The Bank of New York pays for incoming U.S. government securities using the Fedwire transfer system.[48] It then places the securities in its clients' accounts and debits their cash accounts to settle the transaction.

Early in the day on 21 November 1985, the bank began receiving its usual deliveries of U.S. government securities, which under normal conditions should have been immediately passed on to its clients. But a computer failure began corrupting the bank's data files. The failure deleted instructions on where the New York Fed should send the securities, so they were simply held in the Bank of New York's account. Since the securities were not delivered, the purchasers of the securities withheld payment. In the meantime, the New York Fed was automatically debiting the Bank of New York's overdraft account to pay the sellers of the securities. With over 32,200 uncompleted securities transactions and no incoming cash flow from the purchasers, the overdraft quickly ballooned to unheard-of amounts, peaking at US$32 billion. The disruption was so large that some market participants were unwilling to continue trading securities. There was also evidence that investors were cutting off credit to dealers serviced by the Bank of New York—signalling a systemic breakdown of the payments process (Corrigan 1985).

5.1 The short-term policy response

The Fed did not become aware of the Bank of New York's problems until late in the day, very close to the normal end-of-day settlement period (6:30 p.m.). Realizing that the Bank of New York would be unable to eliminate its overdraft position before the normal deadline, the Fed began drafting special loan agreements to provide overnight coverage. The amount of the overdraft was far too large to be provided by any single private bank, or even a syndicate of private banks (and would have taken too long to organize). The New York Fed was the only institution capable of providing that much liquidity to a single borrower on such short notice.

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[46] The Bank of Canada's November 2001 *Monetary Policy Report* contains a discussion of the central bank's policy response following the terrorist attacks.

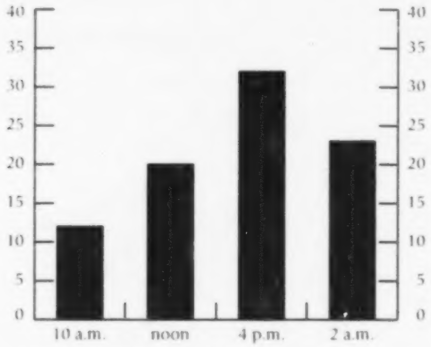
[47] The Bank of New York is a private institution and should not be confused with the Federal Reserve Bank of New York, which is a part of the public U.S. Federal Reserve System. The Bank of New York currently holds over US$6.4 trillion worth of assets in custody for its clients worldwide.

[48] Fedwire is the large-value payment system operated by the Federal Reserve.

Chart 14

Bank of New York's Overdraft at the Federal Reserve

US$ billions



Note: Based on discussion of the day's events in Corrigan (1985)

After the Fed had extended settlement hours from the normal 6:30 p.m. close, it was informed by the Bank of New York, at about 8:30 p.m., that the computer problem had been fixed. Payments resumed, but at an unusually slow pace. Two hours later, it became apparent that not all of the transactions could be settled that evening. There were concerns about fatigue, technical problems, and general uncertainty with keeping the payments system running all night. Also, end-of-day account statements had to be settled before business could resume normally the next day. So, shortly after midnight, the Fed announced that its securities wire would close at 1:30 a.m. and the Fedwire at 2:15 a.m.

The Bank of New York's operating system continued to process transactions very slowly and was unable to clear its securities account before the close. The result was an enormous overnight overdraft of US$23.6 billion (Chart 14), covered by a special loan from the Fed. The loan was almost twice the size of the Bank of New York's normal assets, and 23 times its capital base. Therefore, in addition to pledging all its domestic assets to the Fed, the bank pledged all the securities it had purchased for its clients (Corrigan 1985). The face value of this collateral was estimated at US$36 billion, or about 1.5 times the amount of the overdraft. The Fed required this excess collateral to compensate for the repayment risks. Under normal conditions, the Fed would not have accepted all of these instruments as collateral, but in this case the bank's solvency was not in question.

The next morning, the Bank of New York was still experiencing problems, and its overdraft with the Fed had increased by a further US$2 billion. This prompted the Fed to stop accepting securities transfers destined to the bank, hoping that this would alleviate some of the strain. The plan had unfortunate side effects, however. The Bank of New York was a counterparty to too many other institutions in various markets, many of which were unable to find replacement counterparties and thus incurred losses (Corrigan 1985). Fortunately, the Bank of New York's systems became fully operational by midday, the backlog of securities transactions was eliminated, and Fedwire closed only a few hours later than normal on that day.

5.2 Long-term lessons

The advances to the Bank of New York were made at the prevailing discount rate (7.5 per cent). This cost the bank US$5 million in interest, or 7 per cent of its year-to-date earnings. This charge was also substantial in terms of the profits the bank generated on its clearing activities. Consequently, the Bank of New York was left with a strong incentive to invest in more reliable computer software and to develop more robust contingency plans.

As it happened, the Bank of New York's computer bug struck on an ordinary day in terms of securities volumes. Had it occurred the previous day, when billions of dollars of mortgage-backed securities were being settled for the previous month, the backlog of securities could have far exceeded US$36 billion. Similarly, several other key days during the month, such as an end-of-reserve-period settlement date for banks, or a U.S. Treasury auction or maturity date, could have resulted in a far greater flood of securities.

The 1985 failure highlighted to policy-makers the potential seriousness of operational problems in the payments system. Despite rigorous efforts, operational failures of systemic importance are still an unquantifiable risk. The potential losses of such events have mounted with the growing volume of financial transactions processed in real-time settlement systems. Notably, 16 years later, on 11 September 2001, the Bank of New York experienced its second major operational failure. Although a fully redundant system had been created in the event of another major computer malfunction, both this backup facility and the primary operations centre were located in the area directly affected by the destruction of the World Trade Center. As a result, many of the bank's clients worldwide were unable to access their securities after the terrorist attacks. This impaired their ability to provide U.S. dollar collateral for transactions purposes.

Since 11 September, operational risk and business contingency planning have received far greater attention throughout the financial sector. Indeed, proposed changes to the Basle Capital Accord place a greater emphasis on the identification and management of operational risks.

6. Summary Remarks

The above discussion gives one a taste of the diversity of shocks, sources of instability, short-term policy responses, and long-term lessons associated with actual episodes of stress on financial systems. Despite this diversity, several common themes emerge. In all four cases, the demand for liquidity occurred beyond that which could be accommodated by the market at normal rates of interest; for example, in 1985, when the Bank of New York needed to borrow more than $23 billion with only a few hours notice. In most cases, a loss in confidence was responsible for the contraction in liquidity, resulting in asset-price instability; for example, when the Dow Jones fell by 23 per cent on 19 October 1987. The loss in confidence during these episodes was exacerbated by a lack of sufficient information with which to reprice risk. Several small Canadian banks found it increasingly difficult to access money markets in 1985 for this reason, while in 1998, LTCM's complex financial exposures had pervaded markets to an unknown degree. Finally, in all four episodes, the threat to financial stability was perceived to be great enough at the time to warrant extraordinary policy responses.

In all four cases, the policy responses appear to have been a factor in restoring confidence, which is key for the proper functioning of markets. Furthermore, the responses bridged the gap between the initial shocks and the point at which markets had sufficient information to reprice risk without large premiums for uncertainty. Nevertheless, in retrospect one might debate the severity of the threat that these episodes posed or the merits and effectiveness of the responses. The sense of urgency generated during a crisis has a habit of dissipating with time. Is this because we become consumed in the moment and have a tendency to overreact? Or do we mistake successful policy outcomes for evidence that the threats were exaggerated? Such debates have greatly contributed to the development of better policies and contingency plans for future episodes of financial stress.

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Institutional Arrangements that Promote Financial Stability

Fred Daniel

1. Introduction

A market economy, like Canada's, cannot function well without a strong financial system. An efficient and stable financial system facilitates transactions and properly channels savings into investments. For an economy to perform well, individuals and businesses must be confident that money and financial claims can be reliably and efficiently created, held, transferred, and settled. If the arrangements in place do not work properly, the financial system can become a channel through which shocks are amplified as they are transmitted from one institution to another or from one part of the system to the next. Whether such shocks are of an economic nature or whether they originate in the financial system itself, they can ultimately have a significant impact on the entire economy.

The three essential components of the financial system are clearing and settlement systems, financial institutions, and financial markets. Clearing and settlement systems are at the core of the system's infrastructure. They are the means through which value is exchanged in the economy. They create links between major intermediaries through which funds are transferred and transactions involving financial assets such as securities, derivatives, and foreign exchange are settled. Accordingly, sound clearing and settlement systems are essential for financial stability.

Financial institutions, which include banks, other deposit-taking institutions, insurance companies, and securities firms, perform the key function of financial intermediation. They provide services that facilitate the flow of funds between savers and investors and buyers and sellers. In Canada, the chartered banks have traditionally been the major channel of financial intermediation and have been the participants through which most individuals and corporations have access to the payments system.

The prices and yields of financial instruments are determined through the interactions of buyers and sellers in financial markets. This process of price discovery plays an important role in the efficient allocation of risks and resources as funds are channelled from savings into investment. Financial markets also provide individuals and corporations with a significant source of potential liquidity should they need it.

As discussed in the essay by Alexandra Lai, one aspect of the theoretical literature concerning financial stability involves the extent to which policy-makers can prevent or mitigate financial crises. This can be done by eliminating the sources of fragility, reducing the occurrence of triggers, and containing crises when they occur. Some of the key policy instruments used by the authorities of various countries to prevent or mitigate financial crises are operations as lender of last resort (LLR), prudential supervision, deposit insurance, and the risk-proofing of systemically important clearing and settlement systems. In each country, the specific details and ways in which these policy instruments are applied will differ, reflecting country-specific factors such as the legal underpinnings of the financial sector, public policy objectives, the structure of the financial sector, the development of financial markets, and the design and operation of major clearing and settlement systems.

In Canada, episodes of financial instability have been very infrequent.[1] This is partly because the various policy instruments and institutional arrangements used to promote financial stability are continually reviewed and assessed by the authorities. The policy instruments and institutional arrangements can change as a result of lessons learned from financial crises and in response to research that improves our understanding of the functioning of the financial system. As well, they can be modified to reflect the evolution of the financial system and the adoption of international codes and standards.

This essay examines some of the institutional arrangements that are used to promote financial stability in Canada.[2] These arrangements focus on the three components of the financial system: financial institutions, financial markets, and clearing and settlement systems.

2. Responsibility for Financial Stability in Canada

In Canada, the responsibility for financial stability at the federal level is shared by the Department of Finance, the Bank of Canada, the Office of the Superintendent of Financial Institutions (OSFI), and the Canada Deposit Insurance Corporation (CDIC).

The Department of Finance is responsible for providing policy analysis on Canada's financial sector and developing the legislative and regulatory framework for federally chartered financial institutions (banks, trust companies, insurance firms, co-operative credit associations, and other financial institutions). The department receives policy advice on the design and development of the financial system from OSFI, CDIC, the Bank of Canada, and the Financial Consumer Agency of Canada (FCAC). The recently enacted Canadian Payments Act gives the Minister of Finance enhanced public policy responsibilities and oversight powers in the payments system. The Department of Finance (along with the Bank of Canada) also manages Canada's relations with various international financial institutions and bodies, such as the International Monetary Fund (IMF), the Group of Seven (G-7), the Group of Twenty (G-20), and the Financial Stability Forum (FSF).

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[1] Mark Illing's essay recounts the occurrence of regional bank failures in the mid-1980s.

[2] Other factors also make important contributions to financial stability, for example, the achievement of low and stable inflation and the adoption of prudent fiscal policies.

The Bank of Canada focuses mainly on systemwide issues. The Bank's overriding concern is to promote a financial system that is sound and efficient, and the Bank brings this orientation to policy advice for the design of the financial framework in Canada. The Bank also provides liquidity to the system, in both ordinary and extraordinary situations. In its responsibility for the oversight of certain systemically important clearing and settlement systems, the Bank is concerned with the design and operation of risk-containment measures of these systems. One key goal is to prevent the failure of a participant in one of these systems from having a domino effect that could result in generalized instability. In addition, the Bank provides services to clearing and settlement systems and to their participants to improve the safety and efficiency of these systems. The Bank also undertakes research and works with market participants and securities regulators to improve the understanding and functioning of markets. Finally, the central bank participates with international bodies that deal with financial stability issues, such as the Bank for International Settlements (BIS) and the FSF.

The Office of the Superintendent of Financial Institutions is the primary supervisor of federally chartered financial institutions. OSFI identifies institution-specific risks and intervenes in a timely manner to minimize losses to depositors and policyholders. As well, OSFI contributes to public confidence through the promotion of sound business and financial practices. Internationally, OSFI participates in various bodies such as the Basel Committee on Banking Supervision and the International Association of Insurance Supervisors.

The CDIC is a federal Crown corporation created to guarantee eligible deposits in banks, trust companies, and loan companies against loss in case of member failure. By enhancing depositor confidence, the CDIC contributes to the stability of Canada's financial system. The CDIC also has a statutory objective to promote standards of sound business and financial practices for its member institutions. In addition, the CDIC has contributed to international initiatives in the area of deposit insurance.

Various provincial bodies also help foster financial stability in Canada. In this regard, non-bank financial institutions that are provincially incorporated are subject to provincial supervision.[3] The securities industry is also subject to provincial regulation. For instance, the Ontario Securities Commission administers and enforces the Ontario Securities Act, and the Commission des valeurs mobilières du Québec administers and enforces the Quebec Securities Act. Provincial securities regulators delegate some authority to self-regulatory organizations, such as the Investment Dealers Association of Canada, whose membership includes the majority of firms actively engaged in securities trading in Canada. Traditionally, provincial regulation of securities markets has focused on such issues as disclosure, fair trading practices, and consumer interests. In recent years, the contacts between securities regulators and the Bank of Canada have expanded because of common interests in the operation and evolution of markets.[4]

3. Communication and Coordination among Federal Agencies

The Financial Institutions Supervisory Committee (FISC) is the primary interagency committee used to address issues of financial stability. The FISC was established pursuant to the OSFI Act for the purpose of facilitating consultations and the exchange of information among its members on all matters relating directly to the supervision of financial institutions. Its membership consists of the Superintendent of Financial Institutions (who acts as chair), the Deputy Minister of Finance, the Chairperson of the CDIC, the Governor of the Bank of Canada, and the Commissioner of the FCAC.

The FISC is designed to facilitate consultation and information exchange on supervisory matters that have implications for solvency, last-resort lending, and the risk of deposit-insurance payout. These matters include issues of prudential regulation, the practices and financial condition of individual institutions, and the coordination of actions when dealing with troubled institutions. Hence, the FISC is intended to give the Superintendent, who is responsible for judgments pertaining to the viability and solvency of federal financial institutions, the full benefit of the views of the deposit insurer and the LLR when making supervisory decisions.

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[3] In some cases, OSFI conducts reviews of certain provincially chartered financial institutions by virtue of federal-provincial arrangements or through agency agreements with the CDIC.

[4] As fiscal agent for the federal government, the Bank of Canada has a particular interest in the Government of Canada debt markets. The Bank of Canada, the Department of Finance, and the Investment Dealers Association of Canada (through its Capital Markets Committee) have worked closely to develop the rules and procedures for Government of Canada treasury bill and bond auctions as well as the code of conduct governing trading in wholesale markets for outstanding domestic debt. The Bank of Canada also takes special interest in the operation of the foreign exchange market. For example, a deputy governor of the Bank is the *ex officio* chair of the Canadian Foreign Exchange Committee, which is an advisory committee on market practices composed of the major Canadian participants in the foreign exchange market.

The Senior Advisory Committee (SAC) is a non-statutory body chaired by the Deputy Minister of Finance. The membership of the SAC is the same as FISC. The SAC operates as an ad hoc consultative body and provides a forum for policy discussion on issues pertaining to the financial sector.

The Board of Directors of the CDIC can also provide a forum for the discussion of certain financial stability issues. Board membership includes the Chairperson of the CDIC, five *ex officio* directors consisting of the Deputy Minister of Finance, the Governor of the Bank of Canada, the Superintendent of Financial Institutions and the Deputy Superintendent or an officer of OSFI, and the Commissioner of the Financial Consumer Agency of Canada, as well as five private sector members.

Communication and coordination among federal agencies are essential if the institutional framework is to work effectively to promote financial stability. Each agency plays a unique and complementary role in promoting a sound financial system, and the activities and behaviour of one can affect the operations of the others. For example, prompt intervention by the supervisor when an institution is in trouble can limit the amount and duration of any loans extended by the central bank in its role as LLR, as well as limiting the costs to the deposit insurer. Although the LLR can help to resolve liquidity problems, providing loans to institutions that turn out to be insolvent can result in additional costs for the insurance fund. Similarly, while the supervisory authorities can address institution-specific problems, the risk-proofing of systemically important payments systems is crucial in helping to prevent shocks from being transmitted from one institution to another. Thus, an integrated institutional framework can make a significant contribution to the pursuit of financial stability.

4. The Bank of Canada as Lender of Last Resort

One way in which the Bank of Canada contributes to financial stability is through its powers to act as LLR. In this regard, the Bank of Canada Act allows the Bank to make secured loans or advances, for periods of up to six months, to members of the Canadian Payments Association (CPA).[5]

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[5] All banks operating in Canada are required to be members of the CPA. Credit union centrals, federations of caisses populaires, trust companies, loan companies, and other deposit-taking institutions are also eligible for CPA membership. As of November 2001, the Canadian Payments Act expanded the list of eligible organizations to include life insurance companies, securities dealers, and money market mutual funds.

Although there is no mention of the term "lender of last resort" in the Bank of Canada Act, the preamble to the act sets out a context for the central bank to undertake LLR activities. Thus, there is a presumption that the Bank will act as LLR—a function common to central banks around the world.[6]

The Bank of Canada uses the powers it has under the Bank of Canada Act to provide liquidity in the following situations.

- The Bank provides liquidity, via its standing liquidity facility (SLF), to direct participants in Canada's payments system; i.e., direct participants in the Large Value Transfer System (LVTS) and direct clearers in the Automated Clearing Settlement System (ACSS), which are operated by the CPA. This helps participants in the payments system to transfer value among themselves safely and efficiently during the day with a greatly reduced probability of gridlock situations arising.
- The Bank may provide emergency liquidity assistance (ELA) to eligible financial institutions, or to the market as a whole, in reaction to adverse shocks that cause abnormal increases in demand for liquidity that cannot readily be met from alternative sources. (See Box 1 for a discussion of the concept of LLR and the provision of ELA by the central bank.)

The provision of liquidity under the Bank's SLF is examined in Section 8 on central bank services provided to payments and other clearing and settlement systems and their participants. The provision of ELA by the central bank is discussed below.

4.1 The Bank of Canada and emergency liquidity assistance

The Bank of Canada uses ELA as a crisis-prevention instrument and as a crisis-management tool. In the case of deposit-taking institutions, ELA can be used to mitigate the consequences of a run should one occur. The failure of a deposit-taking institution can have wide-ranging or systemic impacts on the economic welfare of the nation. For example, a failure can lead to a general loss of confidence among depositors in the financial system, which can, in turn, lead to the failure of other financial and non-financial businesses as loans are called and collateral values and asset prices decline. Emergency liquidity assistance can also be used to help address the problem of contagion, where the difficulties of a single institution may cause general concern in the market that other institutions could be subject to the same problems, thus putting the stability of the whole financial system at risk.

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6. The Finance Act of 1914, which provided a governmental "discount window" through which the chartered banks could obtain additional cash reserves on demand, was repealed on 11 March 1935, which is the day that the Bank of Canada commenced operations.

Box 1

The Concept of Lender of Last Resort and the Provision of Emergency Liquidity Assistance by the Central Bank

The classical lender-of-last resort (LLR) doctrine was developed in England during the 19th century. This concept concerns the actions taken, often by the central bank, in a period of financial stress in order to preserve the liquidity of the financial system. The most common application of LLR theory involves a run by depositors on an individual bank. The rationale for the LLR to extend emergency liquidity assistance in this situation is based on the notion that banks, because of the nature of their activities, are vulnerable to a sudden loss of depositor confidence. Banks transform liquid, fixed-value deposits (liabilities) into illiquid, longer-term loans (assets). In undertaking this liquidity transformation, which is a significant source of the value-added in the banking system, banks assume that their depositors will, on average, not withdraw more than a fraction of their funds at any given time. A bank faced with sudden, unexpected withdrawals by a large number of depositors—i.e., a bank run—might be unable to raise funds because of the loss in market confidence, or might be unable to raise replacement funds at or near their usual rates of interest. This could result in the forced liquidation of assets at distressed prices, thereby causing the insolvency of an otherwise solvent bank.

In addition to a run on an individual bank, it is possible for several banks to be affected in a domino fashion; i.e., for contagion or a systemwide bank panic to develop. In the event of a panic, an additional role of the LLR would be to supply liquidity to the market in order to counter the panic, thereby preventing large-scale asset liquidations by banks, and sharp reductions of asset prices, loans, and credit.

The Bank of Canada follows a minimalist approach in the provision of ELA. The Bank considers that, in most circumstances, the financial markets and participants operate efficiently and that intervention by the central bank should be kept to the minimum necessary to achieve the public policy goals of a safe and efficient financial system. There can, however, be rare situations of market failure where, for instance, a solvent and viable institution might be unable to raise needed funds from depositors or other creditors. In such circumstances, the central bank could extend ELA to the illiquid institution, thereby avoiding the inefficient outcome of the failure of a solvent institution. The provision of ELA in such a situation assumes that the authorities have better information than the market with regard to the solvency of the weakened institution.

Emergency liquidity assistance is provided at the discretion of the Bank of Canada. It is the Bank's policy to provide ELA only to those institutions that are judged to be solvent, since it cannot remedy the capital-deficiency problems of an insolvent institution. The Bank has traditionally relied on the institution's supervisor to make a judgment on solvency; in the case of federally incorporated financial institutions, the supervisor is OSFI.[7]

The terms and conditions attached to ELA are intended to reinforce the fact that the Bank is the lender of last resort, rather than of preferred resort, thus helping to deal with concerns about moral hazard. (See Box 2 for a discussion of moral hazard.) The interest rate that the Bank charges on ELA is the Bank Rate, which is higher than market rates. (The Bank can, at its discretion, charge a rate higher than Bank Rate.) Other disincentives to reliance on ELA include the requirement that loans be secured by collateral, that institutions would be subject to heightened supervisory attention, and that such borrowing could affect an institution's reputation.

The Bank of Canada is required by law to lend on a secured basis. In essence, the central bank uses public funds: putting such funds at risk without requiring collateral would involve a commitment that is traditionally made by ministers with Parliamentary approval. Lending on a secured basis protects these public funds, especially in circumstances where the loans are outstanding for an extended period of time during which the solvency condition of the borrower can change. Uncollateralized lending could result in the central bank being overly hesitant and cautious in its lending and, thereby, failing to deal expeditiously with a significant liquidity problem. Secured lending permits the central bank to lend in a timely manner while affording appropriate protection to public funds.

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[7] The Bank relies on solvency judgments from the institution's supervisor because the Bank is not responsible for the prudential supervision of financial institutions.

Box 2

Moral Hazard

The banking system and its users benefit from the existence of a financial "safety net," which often is described as consisting of access to liquidity from the central bank, a deposit-insurance scheme, and government regulation and supervision. The primary purpose of the safety net is to prevent bank runs and panics, as well as to protect small depositors. A well-designed safety net contributes to the stability of the financial system.

A poorly designed safety net can, however, incur associated costs, the primary one being the unintended creation of moral hazard. Moral hazard arises when the provision of a service reduces market discipline, which then allows a financial institution to take excessive risks.

In the case of the LLR, especially in the provision of emergency liquidity assistance, moral hazard arises because institutions, knowing that they have potential access to such advances from the central bank, might therefore be less self-reliant and less cautious in managing their liquidity positions. Market discipline is reduced because unsecured creditors may also expect the central bank to provide these institutions with sufficient funds to meet their liquidity needs. Because unsecured creditors are confident that they will therefore be able to exit from these institutions, they will not monitor the institutions as closely as they might otherwise.

In the case of deposit insurance, moral hazard arises because insured depositors expect that they will not suffer losses if a bank fails. The depositors are therefore less likely to monitor banks and to impose market discipline by lending funds at rates that reflect the riskiness of the institution or by withdrawing deposits when they suspect that a bank is taking on too much risk. Consequently, banks are able to take on greater risk without triggering depositor actions. This results in an inefficient allocation of resources, because weak banks can attract deposits for high-risk ventures at a lower cost than otherwise would be the case.

Moral hazard can be controlled by promoting market discipline, creating appropriate incentives for institutions and investors, and establishing a strong prudential regulatory and supervisory framework. Policy-makers must also be careful not to extend the scope of the safety net beyond what is necessary to achieve public policy objectives. The terms and conditions for LLR loans can be set in a manner that reduces the incentives for institutions to use central bank liquidity (i.e., the central bank should be the LLR, rather than the lender of preferred resort). Deposit-insurance schemes can also be designed with features that mitigate moral hazard. These may include instituting a system of co-insurance, whereby coverage is limited to less than 100 per cent of the value of deposits, placing limits on the scope of the coverage, and implementing a system of differential or risk-adjusted premium assessments.

The framework for banking regulation and supervision can also be aimed at ensuring that institutions implement policies and procedures that appropriately manage risks. Elements such as minimum capital requirements are important in reducing the probability of insolvency: because equity holders have their capital at stake, they provide bank management with incentives to not take excessive risks. Supervisory discipline should also include a policy of non-discretionary early intervention and early resolution. Forcing a troubled institution to deal with problems as soon as they are recognized and in a timely fashion is likely to reduce moral hazard, limit the duration and size of central bank liquidity assistance, and minimize losses to the deposit-insurance fund.

4.2 Providing ELA where a market ceases to function efficiently

The provision of ELA by the Bank of Canada has usually been for the purpose of providing liquidity to individual financial institutions. But the situation could arise where a financial market might cease to function. The very unlikely collapse of a financial market could have systemwide effects. In such an event, where the Governor of the Bank of Canada is of the opinion that there is severe or unusual stress in a financial market or financial system, the Bank has the legal authority, under Section 18. (g.1) of the Bank of Canada Act, to provide liquidity to any market participant via repurchase agreements and outright purchases of a wide variety of securities issued by Canadian or foreign entities, including non-financial firms.[8] These transactions would be aimed at promoting the stability of the Canadian financial system. Section 19 of the Bank of Canada Act requires all transactions of this type to be disclosed in public statements. To date, the Bank has not entered into any such transactions.

5. Regulation and Supervision of Federally Incorporated Financial Institutions

Sound financial institutions make an important contribution to financial stability and efficiency. It is the responsibility of OSFI to administer the various statutes that govern the operation and activities of federally incorporated or registered financial institutions. In 1996, OSFI was given a legislative mandate that makes it clear that it has a responsibility to protect the savings of depositors and policyholders of federal financial institutions. The mandate emphasizes the importance of early intervention in the affairs of troubled institutions. Although the mandate recognizes that supervision may reduce the risk of institutional failure, it also acknowledges that a competitive environment requires an institution's administration to manage risk and that failure of institutions may sometimes occur.

As supervisor, OSFI has the power to require information from the institutions that it supervises and can examine such institutions and gain access to their records. The Superintendent may issue directions of compliance to institutions and, where the circumstances warrant, take control of the assets of a financially troubled institution in an effort at rehabilitation. If rehabilitation fails, the Superintendent may initiate a process to obtain a winding-up order from a court.

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[8] In its day-to-day, open-market operations, the Bank transacts in a limited range of high-quality securities (e.g., Government of Canada securities).

As part of its supervisory activities, OSFI conducts on-site reviews, during which it meets with personnel at the institution and with representatives of external auditors. Under a new supervisory framework introduced in late 1999, OSFI is focusing its examinations on evaluating an institution's material risks and the quality of its risk-management practices. An institution that can demonstrate to OSFI that its risks are contained and managed by strong internal controls may benefit from a reduced regulatory burden.

Under its supervisory approach, OSFI will intervene quickly when problems become evident. OSFI and the Canada Deposit Insurance Corporation have jointly developed a *Guide to Intervention for Federal Financial Institutions*.[9] The guide provides a framework for responding effectively to circumstances that could threaten the viability of a financial institution. With a formal process for early intervention there is a greater likelihood of averting institutional failures by providing incentives for institutions to conduct their business prudently.

The guide also outlines the actions or options available to OSFI and the CDIC, individually and jointly, to address any circumstances that are a source of concern. It defines a graduated and progressive set of responses depending on the institution's particular situation and perceived weaknesses. The guide explicitly and clearly describes the supervisory assessment and intervention process. This makes the system easier to understand and discourages institutions from taking excessive risks.

OSFI is an active participant in international regulatory forums. As financial institutions become more international and as national financial sectors become more interdependent, regulators are harmonizing their approaches and coordinating their efforts. In this regard, the Basel Committee on Banking Supervision is developing the New Basel Capital Accord to replace the 1988 version, which has been widely adopted as the international bank capital standard. The new framework is intended to align capital adequacy more closely with the key elements of banking risks and to provide incentives for banks to enhance their risk-measurement and risk-management capabilities. The conceptual framework for the New Basel Capital Accord is based on three pillars: minimum quantitative requirements, supervisory review, and disclosure requirements. The new Accord is intended to be finalized by the end of 2003 for implementation at the end of 2006.

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[9] The guide is available on the OSFI Web site (http://www.osfi-bsif.gc.ca) and on the CDIC Web site (http://www.cdic.ca).

6. Deposit Insurance

The CDIC is a federal Crown corporation and was created in 1967 to provide deposit insurance and contribute to the stability of Canada's financial system. The CDIC guarantees eligible deposits at member institutions (banks, trust companies, and loan companies) and reimburses depositors for the amount of any insured deposits if a member institution fails.

When designing a deposit-insurance scheme, the authorities try to strike a balance in the trade-offs between public policy objectives (i.e., the potential benefits of deposit insurance) and the creation of moral hazard (i.e., a potential cost of deposit insurance). Deposit insurance can address several public policy objectives. The federal government, in its 1995 White Paper, stated that three reasons for providing public deposit insurance in Canada are to protect against runs on deposit-taking institutions, which might lead to destabilization of the financial system; to ease entry to the financial services sector and thereby foster competition; and to protect the interests of the small, unsophisticated depositor.[10]

The objective of minimizing the risk of runs is based on a concern that, because of real or perceived difficulties, depositors may lose confidence in an institution, which could result in large-scale withdrawals of deposits. Once a run begins, it may lead to contagion with runs occurring at other deposit-taking institutions, to the extent that depositors cannot differentiate between sound and unsound institutions.

Deposit insurance can promote competition and facilitate the entry of new firms by helping smaller institutions compete for deposits against larger institutions. In the absence of deposit protection, depositors are likely to prefer using established, well-known institutions that have a track record and reputation for soundness and prudence.

Deposit insurance can protect less financially sophisticated depositors, who are often distinguished by the small size of their deposits and who often include individuals with limited financial assets and savings. In the absence of deposit insurance, these depositors would be faced with the difficult and complex task of monitoring and assessing the condition of their financial institution.

Specific design features of deposit insurance can help to mitigate the moral hazard present in such systems. The deposit insurance program administered by the CDIC, for example, limits insurance coverage to $60,000 per depositor at each member institution. The maximum basic coverage applies to the aggregated total of all the insurable deposits that an individual has with a member institution, and includes both principal and interest. To be eligible for CDIC insurance protection, deposits must be in Canadian currency, payable in Canada, and have an original term to maturity of no more than five years.

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[10] "Enhancing the Safety and Soundness of the Canadian Financial System," February 1995, Department of Finance Canada, p. 10.

In 1999, the CDIC introduced a system of differential premiums to provide an incentive for member institutions to follow more prudent policies in the conduct of their business. In this way, differential premiums can help control moral hazard better than systems that use flat-rate insurance premiums.

The CDIC has a mandate to minimize the risk of failures among its member institutions and to contribute to the stability of the financial system. In this regard, the CDIC has developed Standards of Sound Business and Financial Practices. The standards require member institutions to have in place sound practices to manage their risks and business activities. In addition, under the *Guide to Intervention for Federal Financial Institutions,* which was jointly developed by OSFI and the CDIC, risks at member institutions are monitored and assessed so that intervention and prompt corrective action may be taken if a member institution should encounter severe financial troubles.

The CDIC also participates in international efforts to assist countries in implementing appropriate and effective systems of deposit insurance. For example, the CDIC played a lead role in a working group of the FSF in preparing the report, *Guidance for Developing Effective Deposit Insurance Systems*, published in September 2001.

7. Oversight of Payments and Other Clearing and Settlement Systems

Payments systems are at the centre of the financial infrastructure and are essential to the smooth functioning of a modern market-based economy such as Canada's. In 1996, the Payment Clearing and Settlement Act (PCSA) was enacted, giving the Bank of Canada formal responsibility for the oversight of payments and other clearing and settlement systems in Canada for the purpose of controlling systemic risk. Systemic risk refers to domino or spillover effects, and is defined in the PCSA as a situation where the inability of one financial institution to fulfill its payment obligations in a timely fashion in a clearing and settlement system results in the inability of other financial institutions to fulfill their obligations in that system or in others, or in the failure of that clearing house or other clearing houses. Such systemic effects can lead to a situation characterized by generalized instability in the financial system, financial markets, and the economy as a whole.

Under the PCSA, the Bank of Canada reviews all eligible payments and other clearing and settlement systems for their potential to pose systemic risk. If the Governor of the Bank forms the opinion that a system has the potential to pose systemic risk, the system may be designated as subject to the act, provided that the Minister of Finance is of the opinion that this is in the public interest. Once designated, a system must satisfy the Bank that it has mechanisms in place to control systemic risk. The Governor of the Bank may issue directives to the system operators or to participants in a designated system in extreme situations where the Governor judges that systemic risk is being inadequately controlled. (See Box 3 for a discussion of the public policy objectives for systemically important payments systems.)

In carrying out its oversight role for designated systems, the Bank has issued the *Guideline Related to Bank of Canada Oversight Activities under the Payment Clearing and Settlement Act.*[11] The guideline describes how the Bank operates under the PCSA and indicates the minimum standards that designated systems are expected to meet in order to adequately control systemic risk.

The LVTS, which is owned and operated by the CPA, has been designated under the PCSA. The LVTS is a real-time, electronic-funds transfer system that processes large-value or time-critical payments quickly and with finality throughout the day.

The Debt Clearing Service (DCS) is owned and operated by the Canadian Depository for Securities (CDS) and has also been designated under the PCSA. The DCS clears and settles trades in Canadian-dollar-denominated debt securities. The DCS uses the LVTS to settle, at the end of the day, the net amounts owed and owing between the CDS and its participants.

The Continuous Linked Settlement (CLS) Bank is an international banking industry initiative to reduce and control the risks associated with the settlement of foreign exchange transactions. The CLS Bank began operations in September 2002. It is wholly owned by CLS Services, whose shareholders are some of the world's largest banks trading in foreign exchange. A number of Canadian banks are also shareholders.[12] The CLS Bank provides a real-time electronic system that links a number of national payments systems and simultaneously settles on its books the foreign exchange transactions submitted to it by its member banks. The CLS Bank is a special-purpose bank under U.S. federal law and is supervised by the Federal Reserve Bank of New York, which is working with oversight authorities in those countries whose currencies are included in the CLS arrangements. The Canadian dollar is one of these currencies, and the Bank of Canada has

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[11] This document is available on the Bank of Canada's Web site (http://www.bankofcanada.ca).

[12] For a discussion of the CLS Bank and its operations, see "The CLS Bank: Managing Foreign Exchange Settlement Risk," by Paul Miller and Carol Ann Northcott, *Bank of Canada Review*, Autumn 2002.

Box 3

Public Policy Objectives for Systemically Important Payments Systems

In the context of financial stability, two important public policy objectives for clearing and settlement systems are safety and efficiency.[1] Safety refers to the appropriate control of risk (credit, liquidity, legal, and operational) so that systems can withstand adverse shocks. As well as seriously disrupting financial markets, a poorly designed system could spread shocks from one participant to another, thereby imposing significant costs on the economy. The Bank of Canada, under the Payment Clearing and Settlement Act, is responsible for oversight of systems for the purpose of controlling systemic risk.

Efficiency refers to the appropriate market arrangements and institutional structures for the allocation and management of resources so that users' needs are satisfied in a timely fashion at the lowest possible price. There may be little to gain from systems that are safe but inefficient, since users will avoid an excessively costly system and will try to process transactions elsewhere. It is therefore important to identify these trade-offs and to strive to achieve a high level of safety at a reasonable cost.

From the perspectives of safety and efficiency, a systemically important payments system would have the following characteristics:

- Participating institutions must be certain that once a transaction has been accepted by the system, that transaction has settled or will settle at the end of the day no matter what else happens.
- Given this certainty of settlement, participating institutions can provide their customers with unconditional use of any funds received through such a system. This important feature is known as "intraday receiver finality."

These characteristics are present in Canada's systemically important payments system, the Large Value Transfer System.

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1. Other public policy objectives for clearing and settlement systems include crime prevention, competition policy, and consumer protection.

designated the CLS Bank under the PCSA. The focus of the Bank's oversight is on the safety of the arrangements to settle the Canadian-dollar part of foreign exchange transactions.

The PCSA gives the Bank of Canada the power to provide a guarantee of settlement to designated systems. The Bank has used this power to guarantee settlement of the LVTS in the extremely unlikely circumstance that more than one participant fails during the LVTS operating day.[13] The PCSA also contains provisions that, when combined with federal insolvency legislation, reinforce the legal enforceability of netting in designated payments and other clearing and settlement systems. The Act also ensures that the settlement rules of designated systems are immune to legal stays or other legal challenges, even in cases where a participant in one of these systems fails. Thus, the PCSA increases the certainty that the legal arrangements governing the operations of a clearing and settlement system will produce the expected outcome in periods of financial stress.

The recently enacted Canadian Payments Act, which was part of the 2001 federal legislation governing financial institutions, provides the Minister of Finance with enhanced public policy responsibilities and oversight powers with respect to the payments system. Under the CP Act, the Minister has the authority to designate a payments system that is national in scope or that plays a major role in supporting transactions in the Canadian financial markets or the Canadian economy. In designating a payments system, the Minister would consider: the level of financial safety provided by the payments system to the participants and users; the efficiency and competitiveness of payments systems in Canada; and the best interests of the Canadian financial system.

Under the Canadian Payments Act, all rules and standards of the CPA are subject to Ministerial approval. The Minister has authority to issue directives to the CPA (as well as to other payments systems designated for oversight under the act) with respect to the conditions for becoming a participant in the system, the operation of the payments system, its interaction with other Canadian payments systems, and the relationship of the system with users. To date, the Minister has not designated any systems under the Canadian Payments Act.

Finally, a non-statutory body called the Payments Advisory Committee (PAC) has been formed to facilitate the coordination of the Bank of Canada's oversight responsibilities under the Payment Clearing and Settlement Act and the Minister's oversight activities under the Canadian Payments

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[13] The central bank guarantee does not involve moral hazard; that is, it does not provide an incentive for the participants to undertake more risk than they might otherwise take. The arrangements in the LVTS provide the participating institutions with incentives to behave prudently in monitoring risk because so much of their own collateral is at stake. In effect, the guarantee by the Bank to the LVTS is akin to the provision of an insurance policy against a catastrophic event that is highly unlikely to occur, and on which there is an extremely large deductible (in this case the collateral put up by the participants under the risk-control arrangements in the LVTS).

Act. The PAC is co-chaired by an Assistant Deputy Minister from the Department of Finance and a Deputy Governor from the Bank of Canada.

8. Central Bank Services Provided to Clearing and Settlement Systems and Their Participants

The Bank of Canada provides services to certain payment, clearing and settlement systems and their participants in order to improve the safety and efficiency of these systems. The LVTS and the ACSS use claims on the Bank of Canada; that is, account balances held in domestic currency at the central bank by the system participants to settle net payment obligations among those participants that participate directly in the systems. Using claims on the central bank for settlement provides a greater degree of safety to participants in the LVTS and the ACSS since there is no risk of failure of the central bank.

As part of its activities as LLR, the Bank provides liquidity via its SLF to direct participants in the LVTS and the ACSS. As noted, the LVTS operates in real time and processes payments throughout the day. In the LVTS, participants' multilateral net debit positions during the day may be negative but are subject to a maximum amount that is covered by collateral pledged to the Bank at the beginning of each day. Thus, the Bank of Canada has enough collateral to make available the necessary liquidity to settle the system in the event that any one of the participants defaults during the operating day. The Bank, under its SLF, also stands ready to provide secured end-of-day advances to the direct participants in the LVTS and to the directly clearing participants in the ACSS. These advances provide participants with access to a reliable backup source of liquidity should they need to fund their end-of-day payment obligations, thus helping participants in the LVTS and the ACSS to transfer value efficiently among themselves during the day.

The Bank of Canada establishes the conditions and the list of securities acceptable for pledging by participants in the LVTS[14] and provides the LVTS system operator with valuations of the securities pledged as collateral. The Bank has built a specialized computer system (the Collateral Valuation and Tracking System) to quickly and accurately monitor and value the collateral pledged by LVTS participants.

The Bank of Canada also acts as settlement agent, or "banker," for the DCS. In carrying out this daily function, the Bank of Canada receives payments from participants in the DCS who owe money to the CDS and makes payments to participants entitled to receive money from the CDS.

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[14] See "Bank of Canada Rules Governing Advances to Financial Institutions," available on the Bank of Canada's Web site (http://www.bankofcanada.ca).

With the Bank acting as settlement agent, so-called "banker risk" is eliminated for the DCS and its participants. Banker risk refers to the possible failure of a private sector institution acting as settlement agent for a clearing and settlement system.

The Bank of Canada also acts as banker for the CLS Bank. The Bank of Canada provides the CLS Bank with a settlement account that it uses to make and receive Canadian-dollar payments arising from the continuous linked settlement service. In addition, since the CLS Bank is not a member of the CPA, the Bank of Canada makes and receives payments through the LVTS on its behalf. The Bank of Canada has extended its overnight operations to provide these services during the CLS processing period.

9. International Co-operation and Initiatives

As an open economy, Canada is very much affected by what goes on in the rest of the world. Thus, Canada has an interest in being actively involved in international forums that study the global economy, issues of financial stability, and initiatives to promote a sound and robust international financial environment.

Efforts are ongoing to strengthen the international financial system, particularly in the aftermath of a series of financial crises in emerging-market economies during the 1990s (Powell 2001). These efforts have focused on crisis management as well as on crisis prevention. The IMF has taken an active role in crisis management, particularly in the case of emerging-market economies. To help the Fund carry out its activities, in the late 1990s the IMF was provided with access to additional resources that could be lent to countries experiencing severe financial difficulties. At the same time, the IMF's lending facilities were modified to meet the need for any short-term financing on a large scale and to encourage countries to return to capital markets as quickly as possible. It is also recognized, however, that the amount of international assistance available to countries from the IMF and other sources is, and should be, limited. This has led to studies that consider the appropriate balance between providing official assistance to countries in crisis and allowing debtors and private creditors to find their own solutions to debt problems. (For example, see Haldane and Kruger 2001–02.) In April 2002, the G-7 ministers and governors released an Action Plan focusing on collective-action clauses, limited official sector lending except in exceptional circumstances, improved surveillance, and complementary work on developing a sovereign-debt-restructuring mechanism. Work is currently underway to implement this Action Plan.

Two additional international groups were also formed in 1999—the G-20 and the FSF. The G-20 brings together finance ministers and central bank governors from industrial and major emerging-market economies, as well as the Managing Director of the IMF and the President of the World Bank. The G-20 facilitates dialogue on the international financial architecture and on issues that are important for the proper functioning of the global economy. Such issues include exchange rate regimes; good practices for transparency in fiscal, monetary, and financial policies; the role of the private sector in crisis resolution; globalization; and combatting terrorist financing.

The FSF provides a means for co-operation in the supervision of financial markets among national authorities, international institutions (such as the BIS, IMF, and World Bank), international regulatory groups (such as the International Organization of Securities Commissions and the International Association of Insurance Supervisors), as well as other experts. The objectives of the FSF are to identify vulnerabilities affecting the international financial system and to improve coordination and information exchange among the various authorities responsible for financial stability. The FSF has examined issues such as offshore financial centres, highly leveraged institutions, capital flows, and international financial standards and codes. In May 2002, following the work begun by the FSF Working Group on Deposit Insurance, the International Association of Deposit Insurers (IADI) was established. The goal of the IADI is to contribute to the stability of financial systems by promoting international co-operation in the field of deposit insurance.

Several committees and working groups at the BIS address financial-stability issues. The Basel Committee for Banking Supervision (Basel Committee) provides a forum for dialogue and collaboration on specific supervisory issues. It also promotes the coordination of supervisory responsibilities among national authorities with the objective that all internationally active banks be supervised on a consolidated basis.

The Basel Committee also seeks to enhance standards of supervision to help strengthen the soundness and stability of international banking. The 1988 Basel Capital Accord achieved international convergence in the measurement of the adequacy of banks' capital and established minimum capital standards. The committee is currently working on developing the New Basel Capital Accord, which will replace the 1988 version. In 1997, with the active contribution of supervisors in emerging-market countries, the Basel Committee issued the *Core Principles for Effective Banking Supervision*. This comprehensive set of principles covers subjects such as preconditions for effective supervision, licensing and structure, prudential regulations, methods of ongoing supervision, information requirements, powers of supervisors, and cross-border banking. Comparable principles were subsequently developed for securities supervision by the International Organization of Securities Commissions (IOSCO) and for insurance supervision by the International Association of Insurance Supervisors.

The BIS provides the secretariat for the Committee on Payment and Settlement Systems (CPSS). The CPSS focuses on issues related to the oversight, efficiency, and stability of these systems. Through its publication of the *Core Principles for Systemically Important Payment Systems*,[15] as well as the joint publication with IOSCO of *Recommendations for Securities Settlement Systems*, the CPSS has contributed to the set of standards, codes, and best practices that help strengthen the financial architecture worldwide. Since its creation, the CPSS has published various reports covering large-value, funds-transfer systems; securities settlement systems; settlement mechanisms for foreign exchange transactions; clearing arrangements for exchange-traded derivatives; and retail payment instruments, including electronic money.

The BIS also provides the secretariat services for the Committee on the Global Financial System (CGFS). The CGFS is a central bank forum for monitoring and examining broad issues relating to financial markets and systems with a view to elaborating policy recommendations to support the central banks in the fulfillment of their responsibilities for monetary and financial stability. The CGFS has published reports on various issues such as credit-risk-transfer instruments, the use of collateral in wholesale financial markets, and electronic trading systems.

The various international codes and standards have become an important tool for identifying both the strengths and vulnerabilities of financial systems. By addressing potential weaknesses, authorities can lessen the frequency as well as diminish the intensity of financial system problems. The IMF and the World Bank have introduced the *Report on Observance of Standards and Codes* (ROSC) and these are used in the IMF's Financial System Stability Assessments (FSSAs) for a country. The ROSC provides an assessment of a country's observance of international standards that are relevant to financial system soundness.[16]

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15. Canada's LVTS is assessed as being in full compliance with the CPSS core principles. See "Core Principles for Systemically Important Payments Systems and Their Application in Canada," by Clyde Goodlet, *Bank of Canada Review*, Spring 2001.

16. In the autumn of 1999, the IMF conducted an FSSA for Canada. The FSSA concluded that Canada's financial system is sound and stable and that its regulatory framework shows a high degree of compliance with major international standards. The IMF's report on the observance of standards and codes for Canada is available on the IMF's Web site (http://www.imf.org).

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